BULLETIN No. 12.

U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF ANIMAL INDUSTRY.

TAPEWORMS OF POULTRY.

REPORT UPON THE PRESENT KNOWLEDGE OF THE TAPEWORMS OF POULTRY. WITH 276 FIGURES ON 21 PLATES.

By CH. WARDELL STILES, A. M., PH. D.

BIBLIOGRAPHY OF THE TAPEWORMS OF POULTRY.

By ALBERT HASSALL, M. R. C. V. S.

Prepared under the direction of

Dr. D. E. SALMON,

CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

Issued July 11 1896.

LIBRARY
RECEIVED
U. S. Department of Agriculture.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

BULLETIN No. 12.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY.

TAPEWORMS OF POULTRY.

REPORT UPON THE PRESENT KNOWLEDGE OF THE TAPEWORMS OF POULTRY. WITH 276 FIGURES ON 21 PLATES.

By CH. WARDELL STILES, A. M., PH. D.

BIBLIOGRAPHY OF THE TAPEWORMS OF POULTRY.

By ALBERT HASSALL, M. R. C. V. S.

Prepared under the direction of

Dr. D. E. SALMON,

CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

Issued July 11 1896.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1896.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., December 21, 1895.

SIR: I have the honor to transmit herewith for publication a "Report upon the Present Knowledge of the Tapeworms of Poultry," by Dr. C. W. Stiles, to which is appended a "Bibliography of the Tapeworms of Poultry," by Albert Hassall, M. R. C. V. S. The subject is a very important one, both from practical and scientific points of view. Our knowledge of the parasites of poultry is in a very unsatisfactory condition, and the contributions to it are so scattered through the literature of the world that they are not available to the greater part of those engaged in the investigation of this and allied subjects. The work of Drs. Stiles and Hassall is well done, and will not only prove of immediate value to poultrymen but it must long stand as a foundation for other scientific investigations.

Very respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
ZOOLOGICAL LABORATORY,
Washington, D. C., December 17, 1895.

SIR: I have the honor to submit herewith for publication a "Report upon the Present Knowledge of the Tapeworms of Poultry," prepared by myself, and a "Bibliography of the Tapeworms of Poultry," prepared by Albert Hassall. The present report was suggested by requests for information coming from officers of experiment stations and others engaged in investigating the diseases of poultry. The drawings to be used in illustrating the report were made by Mr. William S. D. Haines.

Respectfully, yours,

CH. WARDELL STILES,
Zoologist, Bureau of Animal Industry.

Dr. D. E. SALMON,
Chief, Bureau of Animal Industry.

CONTENTS.

Page.

REPORT UPON THE PRÉSENT KNOWLEDGE OF THE TAPEWORMS OF POULTRY. WITH 276 FIGURES ON 21 PLATES, BY CH. WARDELL STILES 9–79
Part I.—General discussion 9–21
Life history and source of infection 11–13
The relation of the tapeworms of wild birds to those of the domesticated fowls 13
Symptoms and pathology 13–17
Tapeworm-infected fowls as food 17
Prevention 17–18
Treatment 18–21
Part II.—Classification 22–79
Analytical key to families and genera 23–25
Family *Bothriocephalidæ* 25–27
Bothriocephalinæ 25–27
Bothriocephalus Rudolphi, 1808 25–26
1. Bertkau's pigeon *Bothriocephalus* sp.? 26
Bothriotænia Railliet, 1892 26–27
2. *Bothriotænia longicollis* (Molin, 1858) Railliet, 1892 26–27
Ligulinæ 27
Ligula Bloch, 1782 27
Family *Tæniidæ* 28–61
Tæniinæ 28
Anoplocephalinæ 28
Mesocestoidinæ 28
Mesocestoides Vaillant, 1863 28
Dipylidiinæ 28–61
Dipylidium R. Leuckart, 1863 29
Cotugnia Diamare, 1893 29–31
3. *Cotugnia digonopora* (Pasquale, 1890) Diamare, 1893 30
4. *Cotugnia bifaria* (von Siebold, 1848) Diamare, 1893 30–31
Amabilia Diamare, 1893 31
5. *Amabilia lamelligera* (Owen, 1835) Diamare, 1893 31
Hymenolepis Weinland, 1858 31–32
Dicranotænia Railliet, 1892 32–36
6. *Dicranotænia coronula* (Dujardin, 1845) Railliet, 1892 33
7. *Dicranotænia æquabilis* (Rudolphi, 1810) Railliet, 1893 33–34
8. *Dicranotænia furcigera* (Rudolphi, 1819) Stiles, 1896 34–35
9. *Dicranotænia sphenoides* (Railliet, 1892) Railliet, 1896 35–36
Drepanidotænia Railliet, 1892 36–45
10. *Drep. lanceolata* (Bloch, 1782) Railliet, 1892 36–37
11. *Drep. fasciata* ([?Rudolphi, 1810] Krabbe, 1869) Railliet, 1893 37–38
12. *Drep. gracilis* ([? Zeder, 1803] Krabbe, 1869) Railliet, 1893 38–39
13. *Drep. anatina* (Krabbe, 1869) Railliet, 1893 39–40

Part II.—Classification—Continued. Page.
Family *Tæniidæ*—Continued.
Drepanidotænia Railliet, 1892—Continued.
14. *Drep. sinuosa* (Zeder, 1800) Railliet, 1893 40–41
15. *Drep. setigera* (Frölich, 1789) Railliet, 1893 41–42
16. *Tænia Krabbei* Kowalewski, 1894 nec Moniez, 1879 42–43
17. *Drep. tenuirostris* (Rudolphi, 1819) Railliet, 1893 43
18. *Drep. infundibuliformis* (Gœze, 1782) Railliet, 1893 43–45
Davainea R. Blanchard & Railliet, 1891 45–55
19. *Dav. proglottina* (Davaine, 1860) R. Blanchard, 1891 47
20. *Dav. circumvallata* (Krabbe, 1869) R. Blanchard, 1891 47–48
21. *Dav. cesticillus* (Molin, 1858) R. Blanchard, 1891 48–49
22. *Dav. echinobothrida* (Mégnin, 1881) R. Blanchard, 1891 49
23. *Dav. tetragona* (Molin, 1858) R. Blanchard, 1891 49–52
24. *Dav. Friedbergeri* (Linstow, 1878) R. Blanchard, 1891 52–53
25. *Dav. crassula* (Rudolphi, 1819) Railliet, 1893 53–54
Echinocotyle R. Blanchard, 1891 55–56
26. *E. Rosseteri* R. Blanchard, 1891 55–56
Ophryocotyle Friis, 1869 56
Tænia s. l., gen. incert. 56–60
27. *T. cantaniana* Polonio, 1860 57
28. *T. Delafondi* Railliet, 1892 57
29. *T. exilis* Dujardin, 1845 58
30. *T. imbutiformis* Polonio, 1860 58
31. *T. megalops* Nitzsch, 1829 59
32. *T. nigropunctata* Crety, 1890 59
33. *T. sp.* Conard, MS 59–60
Fimbriaria Frölich, 1802 60
34. *Fimbriaria malleus* (Goeze, 1782) Frölich, 1802 60
Idiogenes Krabbe, 1868 60
Addendum 60
Explanation of chart 61
Chart of parasites arranged according to their hosts 61
Description of plates 62–73
Index to scientific names 75–79
BIBLIOGRAPHY OF THE TAPEWORMS OF POULTRY, BY ALBERT HASSALL 81–88

ILLUSTRATIONS.

Page.

PLATE I.—*Cotugnia digonopora* 74

II.—*Cotugnia bifaria* and *Amabilia lamelligera* 74

III.—*Dicranotænia coronula, Dicranotænia æquabilis, Dicranotænia furcigera,* and *Tænia conica* 74

IV.—*Dicranotænia sphenoides* and *Drepanidotænia lanceolata* 74

V.—*Drepanidotænia lanceolata* and *Drepanidotænia fasciata* 74

VI.—*Drepanidotænia fasciata* 74

VII.—*Drepanidotænia fasciata* and *Drepanidotænia gracilis* 74

VIII.—*Drepanidotænia gracilis* 74

IX.—*Drepanidotænia anatina* 74

X.—*Drepanidotænia anatina* and *Drepanidotænia sinuosa* 74

XI.—*Drepanidotænia sinuosa* 74

XII.—*Drepanidotænia sinuosa, Drepanidotænia setigera,* and *Tænia Krabbei, Kowalewski nec Moniez* 74

XIII.—*Drepanidotænia sinuosa* and *Drepanidotænia setigera* 74

XIV.—*Drepanidotænia tenuirostris* and *Drepanidotænia infundibuliformis* 74

XV.—*Drepanidotænia infundibuliformis* and *Davainea proglottina* 74

XVI.—*Davainea proglottina* and *Davainea circumvallata* 74

XVII.—*Davainea cesticillus, Davainea echinobothrida,* and *Davainea tetragona* 74

XVIII.—*Davainea tetragona, Davainea Friedbergeri,* and *Davainea crassula* 74

XIX.—*Echinocotyle Rosseteri* and *Ophryocotyle proteus* 74

XX.—*Tænia cantaniana, Tænia Delafondi, Tænia imbutiformis, Tænia megalops,* and *Tænia nigropunctata* 74

XXI.—*Tænia malleus, Idiogenes otidis,* and *Tænia* sp 74

TAPEWORMS OF POULTRY.

REPORT UPON THE PRESENT KNOWLEDGE OF THE TAPEWORMS OF POULTRY.

By CH. WARDELL STILES.

PART I.

GENERAL DISCUSSION.

It has been known for years that tapeworms infest domesticated poultry, and that in some cases they cause serious epizootics among fowls. The outbreaks thus far recorded have occurred chiefly in Europe, and as a natural outcome almost the entire work which has been published on these parasites is the result of European investigations. The literature upon the subject is accordingly in Latin, German, French, Danish, Italian, etc., while in the English language we have only a few short notices concerning these worms. Generic and specific diagnoses of the parasites of this group are almost unknown articles in the English language, while as yet we have absolutely no reliable data as to how many species of tapeworms are found in American poultry.

Several outbreaks of tapeworm disease have been noticed in fowls in different parts of the country, and upon various occasions specimens have been sent to this Bureau for identification. As Dr. Moore (1895)[1] has recently called attention to this disease, and as we shall probably hear of its existence in various parts of the country, it may be well to state at this time what is known regarding the tapeworms of domesticated fowls and, in response to several requests from experiment stations, to give the generic and specific diagnoses as they at present stand.

The following table shows 33 species which have been recorded for poultry, but several of these are doubtful, and probably several forms appear in the list more than once, under different names. Besides the forms given, one or two other forms have been recorded, but can be ignored for the present. A square □ signifies that the parasite is recorded only from poultry; a cross × that it occurs in wild birds, but probably not in poultry; the double cross ⊞ signifies that the parasite is recorded both in poultry and in wild birds.

[1] The dates in parentheses refer to the articles cited in the bibliography, p. 81–88.

Table of tapeworms recorded for poultry.

Name of parasite.	Pigeon.	Turkey.	Guinea fowl.	Peacock.	Chicken.	Swan.	Goose.	Duck.	Ostrich.	Known or supposed source of infection.
BOTHRIOCEPHALIDÆ:										
BOTHRIOCEPHALUS—										
sp. ?	?	..	....	..	....	....	....	....	....	
BOTHRIOTÆNIA—										
longicollis	....	..	....	..	□	....	....	....	....	
LIGULA—										
sp. ?	×	..	....	..	....	....	....	×	....	Does not normally occur in these hosts, experimentally infected by feeding larvæ from fish.
TÆNIIDÆ:										
COTUGNIA—										
digonopora	....	..	....	..	□	....	....	....	....	
DICRANOTÆNIA—										
æquabilis	....	..	....	..	....	?	....	....	....	
coronula	....	..	....	..	....	....	....	⊞	....	Small fresh-water mussel crabs (*Cypris ovum, C. cinerea, Cypria ophthalmica, Candona candida*).
furcigera	....	..	....	..	....	....	....	?	....	See *T. trilineata*, p. 35.
sphenoides	....	..	....	..	□	....	....	....	....	Earthworms (*Allobophora fœtida*).
DREPANIDOTÆNIA—										
anatina	....	..	....	..	....	....	....	⊞	....	Small fresh-water mussel crabs (*Cypris ovata, C. incongruens, C. compressa*).
fasciata	....	..	....	..	....	....	⊞	....	....	Small fresh-water copepods (*Cyclops agilis*).
gracilis	....	..	....	..	....	....	⊞	⊞	....	Small fresh-water mussel crabs (*Candona rostrata, Cypria ophthalmica*) and copepods (*Cyclops viridis*).
infundibuliformis	?	..	....	..	⊞	....	....	⊞	....	House fly (*Musca domestica*).
lanceolata	....	..	....	..	....	....	⊞	⊞	....	
setigera	....	..	....	..	....	?	⊞	....	....	Small fresh-water copepods (*Cyclops brevicaudatus*).
sinuosa	....	..	....	..	....	....	⊞	⊞	....	Flea crabs (*Gammarus pulex*) and copepods (*Cyclops viridis, C. agilis, C. lucidulus*).
tenuirostris	....	..	....	..	....	....	⊞	?	....	Flea crabs (*Gammarus pulex*) and copepods (*Cyclops agilis, C. pulchellus*).
DAVAINEA—										
cesticillus	....	..	....	..	□	....	....	....	....	
crassula	⊞	..	....	..	....	....	....	?	....	
echinobothrida	?	..	....	..	□	....	....	....	....	
proglottina	....	..	....	..	□	....	....	....	....	Slugs (*Limax agrestis, L. variegatus, L. cinereus*).
struthionis	....	..	....	..	....	....	....	....	□	
tetragona	....	..	....	..	□	....	....	....	....	Probably snails (*Helix carthusianella ?* or *H. maculosa ?*).
ECHINOCOTYLE—										
Rosseteri	....	..	....	..	....	....	....	□	....	Small fresh-water mussel crabs (*Cypris cinerea*).
TÆNIA s. l.—										
cantaniana	....	□	....	..	....	....	....	....	....	
conica	....	..	....	..	....	....	....	?	....	See p. 35.
Delafondi	□	..	....	..	....	....	....	....	....	
exilis	....	..	....	..	□	....	....	....	....	
imbutiformis	....	..	....	..	....	....	....	?	....	
Krabbei	....	..	....	..	....	....	□	?	....	See p. 42.
malleus	....	..	....	..	⊞	....	....	⊞	....	
megalops	....	..	....	..	....	....	....	⊞	....	
sp. (Conard, MS.)	....	..	....	..	□	....	....	....	....	
sp	....	□	....	..	....	....	....	....	....	
	2 (6)	2	....	..	11	(2)	7	9 (16)	1	

From this table it will be noticed that 6 different tapeworms have been recorded from pigeons, 2 from turkeys, 11 from chickens, 2 from swans, 7 from geese, 16 from ducks, and 1 from ostriches; 1 form has been recorded as common to pigeons, chickens, and ducks; 5 forms as common to ducks and geese; 1 form as common to geese and swans; 1 as common to pigeons and ducks, and 1 as common to pigeons and chickens. These statistics are based upon the suppositions that all the parasites mentioned are good species, and that the specific determinations of the parasites were correct. A comparison of the original types

would, however, undoubtedly show that both of these suppositions are incorrect, for many of the species are very poorly described, and have been established upon very limited material.

Many of the specific diagnoses existing to-day are almost worthless, some of the species rest upon very weak characters and must undoubtedly fall, while the synonymy and proper names of the group need thorough revision. It would be hazardous to make any radical changes in the system at present, in fact, I do not believe this should be done unless the worker has a large series of specimens, with types, if possible, before him.

LIFE HISTORY AND SOURCE OF INFECTION.

Fortunately the life history of a number of forms is known. So far as yet worked out, the larval stage is in every case a *cysticercoid* and lives in some invertebrate (snail, insect, crustacean, or worm). A glance at the above table and the remarks under each specific diagnosis will show the source of infection (intermediate hosts) so far as known or supposed. There are no grounds for believing that poultry can become infected with tapeworms directly from the eggs contained in the droppings.

The life history of these worms agrees with the life history of other tapeworms; the ova of the parasites are voided with the excrement and are swallowed by an intermediate host; the six-hooked embryo (known as an *oncosphere*) contained within the eggshell then bores its way from the intestine into the body cavity of the intermediate host (a worm, snail, crustacean, or insect) and develops into a larval form (known in this case as a *cysticercoid*). This larva develops into an adult worm when swallowed by a chicken, duck, goose, etc.

The known or supposed life history has been based upon four different methods of work, i. e.—

1. Experimental infection of the fowls by feeding to them known larval stages found in invertebrates, and thus raising the adult stage.
2. Experimental infection of invertebrates by feeding to them the eggs of tapeworms found in birds, and thus raising the larval stage.
3. Comparison of the hooks upon the heads of adult tapeworms of birds with the hooks of larvæ found in invertebrates, and thus associating the young and the old stages.
4. Wild speculation as to the intermediate hosts, based upon negative results and totally devoid of any scientific foundation.

Of these four methods of work the first two give positive proof of the life history when the experiments are successful; the third gives a probability to the statements, but not a proof; the less said about the fourth method the better.

The following are the data we have at present regarding the life history:

1. *Experimental infection of fowls with larvæ found in invertebrates.*

Davainea proglottina[1] of chickens.—Grassi & Rovelli (1888, 1889A, 1892) fed the

[1] There are as yet but few popular names for the various poultry tapeworms. Several new popular names are introduced in the second part of this paper, but for the sake of exactness and brevity it is necessary to introduce the scientific names in all cases.

eggs (Pl. XV, fig. 198) of this tapeworm (Pl. XV, fig. 194) to slugs (*Limax*), and raised the larval stage (Pl. XVI, figs. 199–202) in twenty days. Slugs containing these larvæ were then fed to chickens, and within eight days the four segments were formed. There can, therefore, be no question that chickens become infected with this tapeworm by eating slugs.

Echinocotyle Rosseteri of ducks.—Small fresh-water crustaceans (*Cypris cinerea*)[1] containing a very characteristic larval tapeworm (Pl. XIX, fig. 251) were fed to a domesticated duck by Rosseter (1891A-B, 1892). The duck was afterwards killed and found to be infested with tapeworms possessing the same characteristic head (Pl. XIX, figs. 247–248). The life history of this form must therefore be looked upon as experimentally demonstrated.

2. *Experimental infection of invertebrates by feeding the eggs of avian tapeworms:*

Davainea proglottina of chickens.—This case has been discussed above.

Drepanidotænia anatina of ducks.—Schmidt (1894) has recently demonstrated the life history of this worm in a manner which places the source of infection beyond question. He fed large quantities of tapeworm eggs to fresh-water crustaceans (*Cypris ovata*[1]) and thus raised the larval form (Pl. IX, fig. 110). In summer these larvæ developed in two weeks, but in winter they required over five weeks for their development, the difference in time being attributed to the difference in the temperature. The same larval form is described by Mrázek (1891) also from two other mussel crabs, i. e., *Cypris incongruens*[1] and *Cypris compressa*[1] (= *Cypria ophthalmica* according to Moniez).

3. *Comparison of the hooks upon the heads of the adult tapeworms in birds with the hooks of larvæ found in invertebrates, and thus associating the young and old stages.*

This method of explaining the life history does not furnish the data which are demanded in science of to-day, although it shows what the probable life history is.

Davainea tetragona of chickens.—Piana (1881, 1882) found two larvæ (Pl. XVIII, figs. 228–229) in snails of the genus *Helix*, which he associated with this chicken tapeworm (Pl. XVII, figs. 219–227, Pl. XVIII, figs. 231–235).

Dicranotænia coronula of ducks.—Mrázek (1890) found larvæ (Pl. III, fig. 25) in fresh-water mussel crabs (*Cypris ovum* and *Cypria ophthalmica* (*Cypris compressa*); Rosseter (1890) found a cysticercoid in *Cypris cinerea*, and Moniez (1891) in *Cypria ophthalmica* and *Candona candida*, which the three respective authors have associated with *D. coronula* of ducks.

Dicranotænia sphenoides of chickens.—Grassi & Rovelli (1889A, 1892) claim to have found cysticercoids (Pl. IV, fig. 40) in earthworms (*Allobophora fœtida*) which they associate with this species of tapeworm (Pl. IV, figs. 37–38).

Drepanidotænia fasciata of geese.—Mrázek (1890, 1891) classified a cysticercoid (Pl. VI, figs. 67–70) found in fresh-water crustaceans (Pl. VI, fig. 67) (*Cyclops agilis*) as the larva of this cestode (Pl. V, figs. 56–66).

Drepanidotænia gracilis of ducks and geese.—Cysticercoids (Pl. VIII, figs. 94–99) found in fresh-water mussel crabs (*Candona rostrata* by Scott, 1891, p. 314; *Cypris compressa* by Mrázek, 1891; *Cyclops viridis* by Mrázek, 1891, and *Cypria ophthalmica* by Moniez, 1891, p. 26) and in copepods (*Cyclops* sp.?) by Schmidt, 1894, are looked upon as the larval stage of this parasite (Pl. VII, 80–85).

---

[1] There are no popular names for the numerous different species of small fresh-water crustaceans. The popular name *mussel crabs* is used for the *Ostracoda* (*Cypris, Candona*, etc.); *water fleas* for *Daphnia; copepods* for the *Copepoda* (*Cyclops*, Pl. VI, fig. 67; Pl. XI, fig. 130); *flea crabs* for *Gammarus*.

Drepanidotænia infundibuliformis of chickens and ducks.—Grassi & Rovelli (1889A, p. 404; 1892) state that the larva (Pl. XV, fig. 191) of this parasite (Pl. XIV, figs. 173, 178) is found in the house fly.

Drepanidotænia setigera (Pl. XIII, fig. 154) of geese.—Infection attributed by von Linstow (1892B, p. 503), to a cysticercoid found by Schmeil in copepods (*Cyclops brevicaudatus*).

Drepanidotænia sinuosa (Pl. X, fig. 118) of ducks and geese.—Supposed to develop from cysticercoids (Pl. XI, figs. 130, 135) found in flea crabs (*Gammarus pulex*) by Hamann (1889, pp. 1–7; in copepods (*Cyclops viridis, C. agilis*, and *C. lucidulus*) by Mrázek.

Drepanidotænia tenuirostris of geese.—Supposed larval stage (Pl. XIV, figs. 165, 168) was found in flea crabs (*Gammarus pulex*) by Hamann (1889, pp. 7–9) and von Linstow (1892A, p. 338); and in copepods (*Cyclops agilis* and *C. pulchellus* by Mrázek 1891).

Thus, chickens are *known* to become infected with one tapeworm through eating slugs (*Limax*). They are *supposed* to become infected with a second through eating snails (*Helix*); by a third through eating flies, and by a fourth through eating earthworms.

Ducks are *known* to become infected with two worms through swallowing fresh-water crustaceans, and are *supposed* to become infected with three other tapeworms in the same way; another tapeworm is *supposed* to be transmitted to them through flies.

Geese are *supposed* to become infected with five species of tapeworms by swallowing small fresh-water crustaceans.

Nothing is known in regard to the source of infection of the tapeworms of pigeons and turkeys, but investigations in this field should be based upon the tapeworms of chickens.

THE RELATION OF THE TAPEWORMS OF WILD BIRDS TO THOSE OF THE DOMESTICATED FOWLS.

Only two of the chicken tapeworms (*Dr. infundibuliformis* and *T. malleus*) have as yet been recorded for wild birds, but the majority of the tapeworms found in the domesticated ducks and geese are also recorded from closely allied wild birds; besides these forms, however, many species have been described in wild birds which are not known to occur in the domesticated fowls. (See chart at end of text.) This renders the economic side of the question of avian cestodes extremely complicated and demands a thorough study of the parasites of wild birds in connection with those of our domesticated fowls.

SYMPTOMS AND PATHOLOGY.

From a standpoint of symptomatology, practically nothing is known upon this subject. In general, however, it may be stated that aquatic birds are less affected by the presence of tapeworms than land birds; that young birds suffer more than old birds; and that, although a fowl may harbor a small number of tapeworms without showing any appreciable effects, a heavy infection injures the health and may result in death, as has been abundantly demonstrated by epidemics observed in

different parts of the world. It has also been noticed that poultry are more severely infested in wet years than in dry years, and the general application may be made that poultry kept in damp places will be more heavily infested than fowls kept in dry places. All of these statements are general principles of parasitology.

Zürn (1882, p. 17) gives the symptoms as follows:

> If numerous tapeworms are present in the intestine of young or old fowls a more or less extensive intestinal catarrh develops, corresponding to the greater or less number of parasites present.
>
> The intestinal catarrh shows itself, especially in chickens and geese, as follows: The sick animals become emaciated, although the appetite is not especially disturbed. At times the appetite is even increased. The droppings are thin, contain considerable yellow slime, and are passed in small quantities but at short intervals. The poultry raiser must direct his attention to these thin, slimy, and often bloody droppings, for if any treatment against the tapeworms is to be undertaken, this must be done as early as possible. In observing the droppings it should be noticed whether tapeworm segments or eggs are present. The eggs can be seen, of course, only with the microscope.
>
> After a time other symptoms develop. The sick animals become dull and listless, remain apart from the rest of the flock—the feathers are ruffled and the wings drop, the appetite is lost and the birds allow themselves to be easily caught. Although it was stated that in the beginning of the trouble the appetite is not disturbed, the sick animals develop an intense thirst for cold water. When it rains they run under the eaves in order to catch water, and in winter are eager for ice water.
>
> At reading this some experienced poultry raisers will probably reply that many chickens which are not sick are fond of very cold water. The droppings are also thicker or thinner according to the food. Both of these facts are known to me (Zürn). At the same time I look with suspicion of tapeworms upon every chicken which shows an especial thirst for cold water; and as for the droppings, the fowls infected with tapeworms have droppings mixed with mucus and blood, and pass their excrements much oftener than other fowls do.
>
> The intestinal catarrh often ends fatally.
>
> Upon post-mortem the body is seen to be thin and anæmic. The intestine generally contains no food, the mucosa is soft and hyperæmic and covered with reddish yellow, more or less thick, purulent mucus. According to Hertwig epileptic attacks are frequently noticed in chickens affected with intestinal worms.

The diagnosis by symptoms seems to me very uncertain, and although the symptoms described by Zürn serve as an indication of the disease, they can not be taken as proof. The diagnosis by hunting in the droppings for segments of the parasite is less satisfactory than would be supposed, for it is not rare to find chickens badly infested with tapeworms when it has been impossible to discover segments in the manure. This method is rendered doubly uncertain because the color of the segments is about the same as the urine in the fæces. Microscopic examination of the fæces for eggs is quite a certain though not positive method for diagnosis of tapeworm disease of poultry, but it is thoroughly impracticable for the farmer to attempt it. The best method for the farmer to follow is to kill one of the sick chickens, when he suspects tapeworms, and to cut out the intestine; he should then open the intestinal tract from the gizzard to the anus, in a bowl of warm water, and look for the parasites.

At least one species of tapeworm (*Davainea tetragona*) causes a serious nodular disease in the intestine of chickens which upon superficial examination may easily be mistaken for tuberculosis. This disease was probably first published by Rivolta & Del Prato (1880 or 1881?). It was afterwards described by Piana (1882) as occurring in chickens in Italy, and quite recently Moore (1895) has recorded it in this country. The following is extracted from Moore's article on the subject:

In the spring of 1894, a fowl (*Gallus domesticus*) died at the experiment station of this Bureau with a disease characterized by nodules or tubercle-like bodies in the intestinal wall. Upon closer inspection the lesions were found to be in the subserous and muscular coats, and not, to any appreciable extent at least, in the glands. In the intestinal contents there was a large number of small tapeworms, many of which were firmly attached to the mucosa. Later in the season about twenty fowls from the same flock were used for experimental purposes, and upon post-mortem examination were found to be more or less affected with this disease. In addition to these, one of four fowls which were examined from a flock of poultry on a farm adjoining the experiment station was found to be infested with tapeworms and the intestinal wall studded with nodules. A fowl received from Newbern, N. C., and one from Tacketts Mills, Va., were similarly affected.

Although but one fatal case came under my observation, the extent of the lesions in several of the fowls examined indicated that sooner or later many of them would undoubtedly have succumbed to this disease. The close resemblance of the nodules to tubercles renders necessary a somewhat detailed description of the lesions and of the means by which this disease can be readily differentiated from tuberculosis without the aid of laboratory facilities.

Description of the disease.—The fowl which died apparently from this disease was much emaciated, and the lesions were restricted to the intestinal wall. In the fowls used for other purposes, there were no observable symptoms by which the nodular affection could be detected prior to post-mortem examination. Diphtheria was the immediate cause of death of the fowls from North Carolina and Virginia. All of the fowls examined, affected with this disease, were from one to three years old.

The nodules were invariably more numerous in the lowest third of the small intestine. They occasionally appeared, however, in small numbers in both the duodenum and colon. The larger and to all appearances older nodules were found in the ileum near the cæca.

In the badly affected portion the nodules gave the appearance of closely set protuberances, varying in size from barely perceptible areas of elevation to bodies 4^{mm} ($\frac{1}{6}$ inch) in diameter. In some instances they appeared to overlap one another. When separated by a band of normal tissue they were round or somewhat lenticular in form. In the latter case the long diameter was usually transverse to the long axis of the intestine. The larger nodules were of a pale or dark yellowish color while the smaller ones varied in shade from the more highly colored areas to the neutral gray of the normal serosa. To the touch they gave the sensation that would be expected if the subserous and muscular coats were closely studded with small, oval, solid bodies. The mucosa presented similar elevations. Attached to the mucosa over the nodules were a number of tapeworms. There were also in the more advanced cases a variable number of small (0.5 to 1^{mm}) areas over the larger nodules in which the mucosa had sloughed, leaving small ulcerated depressions.

The larger nodules contained a greenish yellow, necrotic substance which appeared in the advanced stages as a sequestrum with a roughened surface. On section it has a glistening, homogenous appearance. Surrounding the necrotic substance was a thin layer of infiltrated tissue. The smaller nodules contained a more purulent-like substance and the smallest appeared to the naked eye as areas of infiltration. Sections of the affected intestine showed upon microscopic examination that the

heads of the tapeworms had penetrated the mucous membrane and were situated in different layers of the intestinal wall. They were frequently observed between the villi. As would be expected the heads were not readily detected in the necrotic masses contained in the larger nodules, but were almost invariably seen in the smaller ones. In a few sections the tapeworm could be traced through the mucosa to the nodule in the muscular tissue in which its head appeared. In the earlier stage of the nodular development there is a cell infiltration about the head of the worm. This process continues until the infiltrated tissue reaches a considerable size.

The worms attached to the mucosa were usually small. A larger form was commonly found in the intestinal contents. Although macroscopically they appeared to be different, Dr. Stiles found that they were presumably of the same species.

It appears from the literature that this disease has not heretofore been demonstrated in America. In 1881, Piana, described a disease of fowls in Italy, due to the presence of *Tænia bothrioplitis*. His article, however, deals more with the anatomy and classification of the infesting cestode than with the character of the lesions it produced. As he illustrates the nodules and heads of tapeworms in the intestinal wall there can be no doubt of the similarity of the lesions to those in the disease here described. Although fowls and birds are not infrequently infested with tapeworms, the lesions produced by these parasites are, with the exception indicated above, said to be more or less catarrhal in nature.

* * * * * * *

Economic importance.—The importance of this disease is much greater than it at first appears, as the close resemblance of the nodules to those of tuberculosis renders it of much significance from a differential standpoint. As the intestines are stated to be frequently the seat of the specific lesions of tuberculosis in fowls, it is of the greatest importance that a thorough examination be made before a positive diagnosis is pronounced. There are already several statements concerning the presence of tuberculosis in fowls in which the data given are not sufficient to differentiate the disease from the one here described. A somewhat analagous disease of sheep[1] caused by a nematoid (*Œsophagostoma columbianum* Curtice) has led to the deliberate destruction of many animals, the owners believing that tuberculosis was being eliminated from their flocks. As the inquiry into the cause of poultry diseases becomes more general, it is probable that this affection will be occasionally encountered, and unless its nature is recognized it may in some instances, like the sheep disease, lead to an unwarranted destruction of property.

In addition to its importance in differentiating tuberculosis it is in itself a malady worthy of careful attention. The fact that it has already appeared in two flocks in the District of Columbia and also in the States of North Carolina and Virginia, shows that the infesting cestode is quite widely distributed in this country. It is highly probable that the total loss it occasions both from deaths and from the shrinkage of poultry products, due to the chronic course of the disease it produces, is very large. * * *

Diagnosis.—Tuberculosis is, as before stated, the only known disease for which this affection is liable to be mistaken, and it is of much importance that the two diseases should not be confounded. The diagnosis has not in my experience been difficult, as in every case the attached tapeworms were readily detected upon a close examination of the intestinal contents, or of the mucous membrane of the infected portion of the intestine. However, the worms are quite small and could easily be overlooked in a hurried or cursory examination. In case of doubt, if the affected intestine is opened and the mucous surface washed carefully in a gentle stream of water, the small worms will be observed hanging to the mucous membrane. This discovery, in the absence of lesions in the liver or other organs, would warrant the

[1] Animal parasites of sheep, Bureau of Animal Industry, Department of Agriculture, 1890, p. 165.

diagnosis of the tapeworm disease. Although much is written concerning tuberculosis in fowls, especially in Europe, the investigations of poultry diseases by this Bureau have thus far shown that it is not common among fowls in this country.

TAPEWORM-INFECTED FOWLS AS FOOD.

None of the tapeworms of birds are transmissible to man in any stage of their development, and the presence of tapeworms in the intestine of fowls does not in itself warrant the condemnation of their bodies as an article of food.

PREVENTION.

From the nature of the intermediate hosts (fresh-water crustaceans) of the tapeworms of aquatic birds it is evident that nothing can be done to prevent the introduction of larval tapeworms into ducks and geese, if these animals are allowed to visit ponds. Confining the animals to frequently flushed artificial tanks will, however, prevent tapeworm infection.

With chickens, the outlook is somewhat better. An extermination of slugs will insure immunity against *Davainea proglottina*, but no precise directions can be given to prevent chickens from becoming infected with other tapeworms until the life history of these parasites is better understood. It will be well, however, to keep chickens housed in the morning until the sun is well up and the ground is dry, for they will thus be less likely to meet with the supposable intermediate hosts of other worms.

Absolutely nothing can be done at present looking to a prevention of the transmission of tapeworms of wild birds to the domesticated fowls through known or unknown intermediate hosts, except to prevent the domesticated ducks, geese, etc., from visiting ponds.

There is, however, considerable outlook for improvement if different kinds of fowls are alternated in succeeding years upon the same ground, or if the runs and yards of fowls are occasionally changed. From the table (p. 10) it will be seen that thus far none of the tapeworms of chickens are known to occur in turkeys. Whether this immunity of chickens to turkey worms and turkeys to chicken worms is real or apparent, however, is yet to be scientifically determined. Should it prove to be real, then an alternation of flocks of turkeys and chickens in different years will probably insure practical immunity of both birds from any serious outbreaks of tapeworm disease. If, however, turkeys, or chickens, as the case may be, are raised upon the same grounds year after year, it is only natural that those grounds should become thoroughly infested with the larval stages of tapeworms and that fresh outbreaks of tapeworm disease should appear from time to time.

Alternating flocks of geese and ducks promise similar but less satisfactory results.

The safest plan to prevent the spread of poultry worms would be to destroy the manure from infected fowls. If one is not willing to do

this, however, because of its commercial value, he should at least take steps to prevent further infection from it. If the sick chickens are confined to a comparatively small space their droppings can easily be collected and placed in a strong barrel, to which the access of snails, slugs, worms, etc., should be guarded against. It is not known how long the eggs of poultry tapeworms will live, but it seems very doubtful to me whether they could live many months in such a barrel if placed in a dry spot. It seems almost certain that they could not live through the winter. The temperature required to kill the eggs has likewise not yet been determined, but probably 50° C. to 60° C. (122° F. to 140° F.) would suffice. Sulphuric acid (10 per cent) or quick lime is an excellent disinfectant for fæces containing eggs of parasites.

The proper care of the manure from infected fowls is unquestionably the most important preventive measure against tapeworm disease.

TREATMENT.

The treatment of tapeworm disease in the domesticated fowls must for the present be more or less experimental, as the records in this line are extremely limited.

The first rule to be carried out in all cases of diseased animals, whether chickens, turkeys, geese, ducks, or others, is to isolate them from the rest of the flock and keep them confined until they have recovered. The second rule is to destroy the droppings of all animals known to be infected with parasites, or if the manure is needed as fertilizer, it should be treated in such a manner so as to kill the ova. These two rules can be easily carried out, and if a poultry raiser or a stock raiser is not willing to set aside a small yard for the isolation of the sick animals, where their droppings can be easily collected and taken care of every day, it is almost useless for him to administer anthelmintics to his fowls or other animals.

The chief drugs used against tapeworms are: Extract of male fern, turpentine, powdered kamala, areca nut, pomegranate root bark, pumpkin seeds, and sulphate of copper (bluestone).

Areca nut.—According to Zürn, powdered areca nut is the best tapeworm remedy for fowls, but he calls attention to the fact that turkeys are unfavorably affected by this medicine.

Zürn advises the administration of powdered areca nut in doses of 2 to 3 grams (=30 to 45 grains), mixed with butter and made into pills.

Liquid extract of male fern is very effectual against tapeworms. Hutcheon advises a teaspoonful for young ostriches three to four months old, to a tablespoonful for a full-grown ostrich; it may be made into a pill with flour.

Turpentine may be given to ostriches in doses of a desertspoonful for chicks three to four months old, to two tablespoonsful for a full-grown bird; its action is much more effective when combined with a purgative, such as linseed or castor oil. (Hutcheon.)

The Bureau has recently made the following experiments upon chickens to determine in what doses turpentine may be administered to them without danger. As in the experiments with bluestone cited below, a small rubber tube was inserted through the mouth to the crop, and the medicine forced through the tube with a large bulb pipette. This insured the deposit of the entire dose into the crop, and proved to be a most excellent method of administering the liquid, since it caused no pain to the animal, a chicken's gullet being quite large and easily admitting a $\frac{3}{16}$-inch (outside measurement) rubber tube.

No. 121. Full-grown chicken.

Jan. 13, dosed with 5^{cc} turpentine. Effects: Slight diarrhœa.

Jan. 16, dosed with 15^{cc} turpentine. Effects: Severe diarrhœa; animal sick and listless; complete recovery in three days.

No. 122. One-year-old chicken.

Jan. 13, dosed with 10^{cc} turpentine. Effects: Moderate diarrhœa.

Jan. 16, dosed with 25^{cc} turpentine. Effects: Very severe diarrhœa; animal quite sick and refused food; complete recovery in six days.

No. 123. Full-grown chicken.

Jan. 14, dosed with 15^{cc} turpentine. Effects: Moderate diarrhœa.

Jan. 16, dosed with 30^{cc} turpentine. Effects: Very severe diarrhœa; animal very sick and refused food; complete recovery in six days.

After performing these preliminary experiments in the laboratory I requested Dr. Schroeder to treat a larger number of fowls at the Experiment Station with doses of 15^{cc} turpentine, noting the age, sex, weight, etc., of the animals. Of these experiments he has handed me the following notes:

Each chicken in the following table received a dose of one-half ounce (14.785^{cc}) of spirits of turpentine injected through a rubber tube directly into the crop. The experiments took place from February 19 to February 25, 1896.

Number and sex.	Variety.	Weight.		Approximate age.		Remarks. [♂ = roosters, ♀ = hens.]
		Lbs.	Oz.	Years	Months	
125. ♀	Black mongrel	4	3	2–3	.....	Two to three hours after the drug was given the chickens acted depressed and uneasy. Later they showed great drowsiness, were extremely thirsty, and passed large quantities of fluid, but very little solid fæces. In a few cases the respiration was labored. All the animals, with the exception of No. 151, made a good recovery in from 48 to 60 hours.
126. ♀	do	3	10	3	.....	
127. ♀	do	3	7	1	6	
128. ♀	do	2	7.5	1	6	
129. ♀	do	2	3.5	1	.....	
130. ♂	Black and white mongrel.	4	5	1	.....	
131. ♂	do	3	9.5	1	.....	
132. ♂	do	2	10.5	1	.....	
133. ♂	White mongrel	2	.....	.....	6–8	
134. ♀	Buff mongrel	2	9.5	3	.....	As far as it is possible to determine any difference in the action of turpentine on the different chickens from the small number included in the experiment, it seems as if the Black Spanish suffered more severely than the other varieties. No difference was noticed between the hens and roosters, but the younger and lighter-weight animals responded more than the older and heavier chickens.
135. ♂	Plymouth Rock	6	7.5	3	.....	
136. ♀	do	5	2	4	.....	
137. ♂	do	5	.....	1	6	
138. ♀	do	4	9.5	3	.....	
139. ♀	do	4	9.5	3	.....	
140. ♀	do	3	13.5	3	.....	
141. ♂	do	2	10.5	.....	9	
142. ♀	do	2	10.5	4	.....	
143. ♂	Leghorn	4	6	2	.....	
144. ♀	Brown Leghorn	3	6.5	2–3	.....	
145. ♀	do	2	12	3	.....	
146. ♀	Buff Leghorn	4	10	3	.....	Chicken No. 151 died about twenty-eight hours after being dosed. Post-mortem: Intestine almost throughout its entire length congested in form of fine points; liver engorged with blood; heart, muscle pale, ventricles empty; kidneys apparently normal; one lung considerably congested (possibly some turpentine entered the windpipe); no parasites in the intestine. Previous to death chicken showed considerable difficulty in breathing.
147. ♀	do	2	3.5	3	.....	
148. ♀	Black Spanish	3	5	2	.....	
149. ♀	do	2	10	1	.....	
150. ♀	do	2	5	5	.....	
151. ♀	do	2	1.5	1	6	
152. ♀	Hamburg	3	8	4	.....	
153. ♀	do	2	6	3	.....	
154. ♀	Game	2	12	1	6	
155. ♀	do	1	10	.....	6	

Thus, out of 32 chickens dosed with half an ounce (about 15^{cc}, about 1 tablespoonful, about 2 dessert-spoonfuls, about 4 teaspoonfuls) of spirits of turpentine, one died. In another case dosed with 25^{cc}, in still another dosed with 30^{cc} (about 1 ounce, or 2 tablespoonfuls) of turpentine-the animals were very sick, but recovered.

It will be well, therefore, to make half an ounce (about 15^{cc}, or 1 tablespoonful) the maximum dose. As a safe rule, we can adopt 1 teaspoonful (about 4^{cc}, about one-eighth on an ounce) to 3 teaspoonfuls (about 12^{cc}, about three-eighths of an ounce) as the dose for chickens, the size of the dose being determined by the size of the chicken.

It will be noticed that the above experiments were made to determine how much turpentine could be safely given to chickens. As there was no outbreak of tapeworm disease among the fowls used in the experiment, no observations could be made on the effects of the medicine upon the tapeworms which occur in chickens. Turpentine is, however, one of the recognized remedies against tapeworms.

Powdered kamala.—Mégnin states that very good results followed the use of this drug, mixed with the food, against tapeworms of pheasants. Hutcheon advises for ostrich chicks one month old 1 drachm, two months old 1½ drachms, three to four months old 2 drachms, eighteen months old 1 ounce, a full-grown ostrich 2 drachms more. It does not require to be mixed with a purgative. Powdered kamala may be given mixed in a little milk or water, or it may be made into pills with a little flour and water.

Pumpkin seeds.—These, according to Zürn, are not well borne by turkeys and not always by chickens, but it would be well to experiment further with them.

Pomegranate root bark.—Very effective against tapeworms in ostriches, but must be given in large doses and followed by a purgative. (Hutcheon).

Sulphate of copper (*bluestone*).—This is an excellent tæniacide in calves and lambs but the doses for fowls have not been determined.

In some experiments which are now in progress I have given 60^{cc} of a solution of 1 ounce sulphate of copper to 3 pints of water to a full-grown hen without noticing any ill effects from the dose. Thirty ^{cc} of the same mixture killed a half-grown rooster within twenty-four hours. Upon post-mortem it was found that the worms in the intestine were dead. Another half-grown chicken was dosed with 45^{cc} of the same mixture and bore the dose very well.

I am not prepared to recommend bluestone for chickens at present, except in experiments, and would direct attention to the danger of allowing the solution to enter the windpipe, as a very small dose of this solution will kill a fowl if the medicine reaches the respiratory organs. As a safe method of experiment, I have inserted a thin rubber tube to the crop (a catheter would answer equally as well) and forced the medicine through this tube. This method obviates the danger mentioned and is borne very well by the chickens. I caution again, that a large series of experiments in this line is needed before bluestone can be recommended for general use in dosing fowls.

Perroncito advises the following treatment for tapeworms in chickens (dose for one chicken):

(1) Aloes (socotrine or caballine), 15 to 20 centigrams. The animal is fasted the same day.

(2) Pumpkin seeds, 40 to 50. Administered to each chicken on the second day. Or—

(3) Male fern, powdered, 100 grams. Mixed in bran.

All of the above medicines should be procured as fresh as possible. Many failures in treating for tapeworms are due to the fact that old drugs have been used which had lost their anthelmintic properties.

PART II.

CLASSIFICATION.

Part II contains the descriptions of the tapeworms found in poultry and a discussion of the different species, and it is placed for the most part in fine type because of its rather technical nature. There are, however, a number of points mentioned under the various species which are necessary to the poultry raiser who desires to obtain a thorough knowledge of this subject. I have endeavored to bring together in Part II the entire history of each species, in order to show the exact status of our present knowledge of the group.

The Bureau is gradually collecting the original types of many of these species, with a view to revising the entire group and placing it upon a more scientific basis. It is our desire also to obtain all the material possible from various parts of this country, and we invite poultry raisers, etc., to send us specimens they may find in their birds. The Bureau will furnish bottles of alcohol or formalin, and mailing cases for such sendings. All correspondence should be directed to Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

Worms sent to us for study or identification should first be washed in warm water and then placed in alcohol or in the preserving fluid furnished by the Bureau.

The following classification by genera is largely based upon the papers by Blanchard (1891B) and Railliet (1892B and 1893). In the specific diagnoses, the original descriptions and figures have been consulted as far as possible and data derived from them have been combined with more recent diagnoses and descriptions.

It would be well if authors making and publishing specific determinations in this group would preserve their specimens in some way, so that they may be used by later writers on the subject, for in many of the species described below the determination can be looked upon only as approximate and provisional. The specific determination of these forms is of much greater importance from a practical standpoint than is generally assumed, for an exact knowledge of the species is necessary as a foundation for general preventive measures.

Nomenclature.—In several places where it is perfectly evident that the parasites are now sailing under wrong names, I have corrected the names according to the international rules. In the majority of cases,

however, I postpone changes until I can complete a revision of the entire group based upon original material.

In the systematic arrangement given below keys are given not only to the species of adult tapeworms of domestic fowls, but also to some closely allied forms. The allied genera and subfamilies are given in the keys in order to show the general relationships of the group.

The tapeworms of fowls belong to two families, the *Bothriocephalidæ* and *Tæniidæ*.

Regarding the generic position of the tapeworms of domesticated fowls it may be stated that up to within very recent years nearly all of the forms have been placed in the collective genus *Tænia*. To R. Blanchard and A. Railliet is due the chief credit of pointing out the absolute absurdity of uniting these forms generically with such forms as *Tænia solium* of man. True, other authors had recognized the great difference in some characters, but the group is such a difficult one to handle that helminthologists, either from lack of time, material, or courage, have carefully avoided any attempt at a natural classification.

Blanchard brought some order into the group in 1891 by proposing the new genera *Davainea* and *Echinocotyle* for certain forms, while Railliet followed up the work by proposing the genera *Drepanidotænia*, *Dicranotænia*, and *Bothriotænia* for certain other forms. These five new genera, together with *Mesocestoides*, *Ophryocotyle*, *Cotugnia*, and *Amabilia* enable us to make a provisional classification by genera. It should, however, be remembered that this classification is necessarily provisional in nature, as the internal anatomy of these worms is as yet very poorly understood, and a thorough study of that subject will probably result in great changes.

Regarding the species it may be again remarked that a considerable number of different forms have been described, but that a number of these species will unquestionably fall, while new species will have to be described for forms which are not yet recognizable as distinct.

ANALYTICAL KEY TO FAMILIES AND GENERA.

(*For genera already recorded in poultry follow italics.*)

1.	*Head with two elongated grooves or slit-like suckers; rostellum wanting; uterus with special pore; genital pores generally dorsal or ventral*	BOTHRIOCEPHALIDÆ, 2
	Head with four cup-shaped suckers; rostellum present but not always evident; uterus without any special pore; genital pores generally marginal	TÆNIIDÆ, 7
	Head is (always?) absent	17
2.	*Body without external segmentation; head without suckers, or two weak slit-like suckers develop (Ligulinæ)*	LIGULA, p. 27
	Body with external segmentation; head with two elongate slit or groove-like suckers	BOTHRIOCEPHALINÆ, 3
3.	*Genital organs single in each segment*	4
	Genital organs double in each segment	6

4. *Genital pores lateral (marginal)* ..... BOTHRIOTÆNIA, p. 26
   Genital pores ventral or dorsal 5

5. Penis, vulva, and uterus open ventro-median ..... BOTHRIOCEPHALUS, p. 25
   Penis and vulva ventro-median; uterine pore dorso-median ..... PTYCHOBOTHRIUM

6. Penis, vulva, and uterus open ventrally ..... KRABBEA
   Penis and vulva ventral; uterus opens dorsally ..... DIPLOGONOPORUS

7. Genital pores ventro-median (gen. *Mesocestoides*) ..... MESOCESTOIDINÆ, p. 28
   Genital pores lateral (marginal) 8

8. Head never provided with hooks; uterus transverse or reticulate; egg generally with pyriform body; larval stage not known; adults in herbivorous mammals .. ANOPLOCEPHALINÆ, p. 28
   Head nearly always provided with hooks (T. saginata exception, see also *Hymenolepis*) 9

9. Egg with thin outer shell and thick brown inner shell; uterus median and longitudinal with lateral branches; larval stage a *Cysticercus, Cœnurus* or an *Echinococcus* generally in herbivora; adults in carnivorous mammals ..... TÆNIINÆ, p. 28
   Egg with thin transparent shells; frequently in egg capsules, in some cases scattered through the segment; head nearly always armed with hooklets on rostellum; larval stage a cysticercoid; adults in birds and mammals ..... DIPYLIDIINÆ, 10

10. *Suckers unarmed* 11
    Suckers armed with minute hooklets (with four exceptions known only in birds) 16

11. *Genital pores double* 12
    Genital pores single, irregularly alternate or unilateral ... 14

12. *Two submedian ovaries in each segment* 13
    One median ovary in each segment ..... AMABILIA, p. 31

13. Several rows of hooks upon rostellum ..... DIPYLIDIUM, p. 29
    A single row of hooks upon rostellum ..... COTUGNIA, p. 29

14. *Dorsal*[1] *root of hooks much longer than ventral root or prong; ventral root very short; hooks 8 to 12 (rarely to 26) in number; known only in birds* ..... DREPANIDOTÆNIA, p. 36
    Dorsal root of hooks about the same length as ventral root and prong 15

15. *Dorsal root shorter than prong or ventral root; hooks generally less than 20 in number (range from 10 to 26); genital pores unilateral or irregularly alternate; known only in birds* ..... DICRANOTÆNIA, p. 32
    Dorsal root longer than prong or ventral root; if rostellum is armed there are 24 to 30 hooks present; genital pores unilateral (on left of segments); 3 testicles normally present in each segment; retractile rostellum armed with minute hooklets or rudimentary and unarmed; eggs with 3 envelopes; parasitic in man, chiroptera, insectivora, rodents, and insectivorous birds; larval stage in insects or myriapoda ..... HYMENOLEPIS, p. 31

[1] As the terms *anterior* and *posterior* in referring to the roots of the hooks are reversed by some authors, I suggest the use of the words *dorsal* and *ventral* in their place. These words are not open to misinterpretation, the *dorsal* root being a continuation of the dorsum of the prong; the *ventral* root lies under the prong.

16. *Hooks on suckers arranged in circular rows on border; hooks on rostellum resemble a hammer in form and arranged in a double row;* with four exceptions known only in birds ..... DAVAINEA, p. 45

Hooks on suckers arranged in several transverse rows; hooks of infundibulum very small (4 μ) arranged in a single row; known only in birds ..... OPHRYOCOTYLE, p. 56

Hooks on suckers arranged in one median set and two lateral sets; hooks on rostellum provided with long dorsal root and arranged in a single row; known only in birds. ECHINOCOTYLE, p. 55

17. *Anterior extremity of strobila expanded in form of a hammer* ..... FIMBRIARIA, p. 60

Anterior segments become caliciform and function as a pseudoscolex ..... INDIOGENES, p. 60

Family **BOTHRIOCEPHALIDÆ.**

Diagnosis: Head provided with two groove or slit-like suckers; rostellum wanting; uterus with special pore; genital pores generally (possibly always) dorsal or ventral. Type genus: *Bothriocephalus* Rud., 1808.

The tapeworms of birds which belong to this family are classed in two (of the several) subfamilies. The forms recorded for the domesticated fowls are of little importance and the records of them are very incomplete. Three species have been reported from poultry. The first of these (*Ligula*) has been developed experimentally in ducks and pigeons; a second species (*Bothriotænia longicollis*) has been recorded but once from chickens, and a third form (a "*Bothriocephalide*") is recorded once from a pigeon.

Subfamily **Bothriocephalinæ.**

Diagnosis: Body with distinct external segmentation; head with two elongate slit or groove-like suckers. Type genus: *Bothriocephalus* Rud., 1808.

This subfamily contains among other forms the species mentioned above (*Bothriotænia longicollis*) from chickens, the undetermined genus and species from the pigeon and a number of species of the genus *Bothriocephalus* found in wild birds.

Although an unimportant subfamily so far as the domesticated fowls are concerned, it is quite an important one in human and comparative medicine. Six of its species (*Bothriocephalus latus, B. cristatus, B. cordatus, B. liguloides, B. Mansoni* and *Krabbea grandis*) occur in man, while several forms are recorded from dogs.

Genus **BOTHRIOCEPHALUS** Rudolphi, 1808.

(1819, *Dibothrius* Rudolphi; 1850, *Dibothrium* Diesing.)

Diagnosis: Two suckers present; penis, vulva, and uterus open ventro-median. Type species:[1] *B. latus* (Linné, 1758), Bremser, 1819.

---

[1] If the rules of nomenclature were strictly adhered to there would be a general rearrangement of the species now included in *Bothriocephalus*. The species now known as *Ptychobothrium claviceps* (Goeze, 1782) was used by Rudolphi as the first species of *Bothriocephalus*, but within recent years *B. latus* of man has been tacitly

No species of this genus as at present revised (Blanchard, 1894, p. 699–702) is known to occur in domesticated fowls, although the pigeon "*Bothriocephalide*" may conveniently be placed here at present; several species (*B. dendriticus*, *B. ditremus*, *B. fissiceps*, *B. podicepedis*) are found in wild birds. For *Bothriocephalus longicollis* see *Bothriotænia longicollis*, p. 26.

1. Bertkau's Pigeon Bothriocephalus, gen. et sp. incert.

Cornelius (1875) mentions the occurrence of a tapeworm in a carrier pigeon at Eberfeld; he states that it was a true *Tænia*, but Bertkau, in a footnote to Cornelius's paper, remarks that it is a "*Bothriocephalide*," as it possessed two suckers.

The worm was yellowish white in color, 24^{cm} long; two suckers but no hooks on the head; neck short; anterior segments very short and straight, segments increasing in breadth to 6^{mm}, then decreasing again toward the posterior extremity; margin of strobila serrate.

The host had been listless and dull, but regained its natural condition after the expulsion of the worm.

Railliet (1893, p. 329), in referring to this form, mentions also a case recorded by Itzigsohn (Neudamm, Brandenburg). Dr. Itzigsohn was called to see a child which, he was assured, had vomited a worm, and, in fact, a *Bothriocephalus* was shown to him. An investigation, however, showed that the child had been playing with a pigeon, killed the evening before by the child's father; upon examining the bird a similar worm was found.

From the data given it is utterly impossible to determine these worms, and it appears useless to attempt it.

Genus **BOTHRIOTÆNIA** Railliet, 1892.

Diagnosis: Two suckers present; genital pores lateral (marginal). Type species *Bothriotænia longicollis* (Molin, 1858) Railliet, 1892.

2. Bothriotænia longicollis (Molin, 1858) Raillet, 1892.

(1858, *Dibothrium longicolle* Molin; 1878, *Bothriocephalus longicollis* (Molin, 1858) von Linstow).

Diagnosis: 18^{mm} to 27^{mm} long by 4^{mm} wide. Head small, claviform, thick, with 2 marginal oblong suckers, and a small central depression on the summit. Neck long and very thin. Body tænioid, flat, with 2 longitudinal grooves. Anterior segments very short; the following segments almost square, overlapping; posterior segments transverso-elliptic, thick with rounded borders. Gravid segments show a

---

understood by zoologists as representing the type species of the genus. This view, however, can not be accepted, as Rudolphi did not mention this form among his species of this genus. Strictly speaking, the generic name *Ptychobothrium* should fall into synonymy under *Bothriocephalus* (type *B. claviceps*) and a new generic term should be given to the group of which *B. latus* is now taken as type. This would, however, be a radical step and could be taken consistently only in a revision. Another solution of the problem, which would have the advantage of creating less confusion, would be to accept another species as type of *Bothriocephalus, which must obviously be one named by Rudolphi in 1808–1810,* with penis, vulva and uterus opening ventrally.

mosaic structure of dark, angular spots due to egg sacs. Genital pores unilateral, about in the middle of the margin.

Development: Unknown.

Host: Chickens (*Gallus domesticus*), by Molin.

Distribution: Pavia, Italy (by Molin and Polonio).

Molin seems to be the only author who has made any original observations on this worm, and these are not extended enough to give us any clear idea of the parasite in question. The egg sacs, unilateral pores, and the central depression on the summit of the head recall *Davainea* (vide p. 45), with the query whether Molin was really not in error in describing two suckers instead of four. Such an error would be an extremely easy one to fall into, as the suckers of avian cestodes are frequently indistinct or lost.

At all events, Molin's original specimens should be reexamined, as nearly forty years have now passed since the worm was first found; it has not been collected in recent years, although the chicken has frequently been examined for tapeworms.

Subfamily **Ligulinæ.**

Diagnosis: Body without distinct external segmentation; head without suckers, or two slit-like suckers may develop; genital pores ventral. Type genus *Ligula* Bloch, 1782.

Genus **LIGULA** Bloch, 1782.

Diagnosis: Body not segmented externally, but the genital organs are repeated and the three genital pores (penis, vulva, and uterine pore) of each set open ventrally; head without distinct suckers, or 2 longitudinal slit-like suckers may develop.

Life history: The larval form lives in the abdominal cavity of fish (particularly *Cyprinidæ*), the adult in the intestine of various piscivorous birds.

This genus does not normally occur in domesticated birds, but Duchamp (1876, quoted in Duchamp, 1877) infected ducks and pigeons (1877) with the larval form taken from the tench (*Tinca vulgaris*); he also (1878A) raised the adult in the peritoneal cavity of a dog. Donnadieu (1877) fed young ligules to ducks, and after twenty to thirty hours found adult ligules with eggs in these birds in some of his experiments, although in other infections of ducks his results were negative. Riehm (1882) also succeeded in infecting ducks with ligules.

From a piscicultural standpoint the immature stage of this parasite is of considerable importance, for it occasionally gives rise to serious epizootics among fish (for historical review, cf. Donnadieu, 1877).

A large number of species have been insufficiently described by various authors. Donnadieu unites them all with *Schistocephalus* under the name *Dibothrium ligula;* other authors, however, are inclined to recognize two species, i. e., *Ligula uniserialis* Rud., 1810 (Syn. 1839, *L. monogramma* Creplin), and *Ligula alternans* Rud., 1810 (Syn. 1839, *L. digramma* Creplin). The term *L. simplicissima* Rud., 1802, is generally applied to the asexual form in fish.

{ Genital organs simple, uniserial ..... *L. uniserialis.*
{ Genital organs double and alternating ..... *L. alternans.*

Family TÆNIIDÆ

Diagnosis: Head with 4 cup-shaped suckers; rostellum present but not always evident; uterine pore wanting; genital pores generally marginal; body always segmented. Type genus: *Tænia* Linné, 1758.

This family is an extremely important one from an agricultural standpoint as all the tapeworms of domesticated animals (with the exception of a few belonging to the *Bothriocephalidæ*) are classified here. Probably all of the tapeworms normally found in poultry belong to the subfamily *Dipylidiinæ.*

The subfamily *Tæniinæ*[1] (type genus: *Tænia* Linné, 1758) contains mostly large tapeworms, the adult stage of which lives in carnivorous animals (*T. saginata* of man, *T. marginata* of dogs, for instance) while the larval stage lives in herbivorous animals (*Cysticercus bovis* of cattle, *C. tenuicollis* of sheep, cattle, etc.).

The subfamily *Anoplocephalinæ* (type genus: *Anoplocephala* E. Bl., 1848) contains most of the adult tapeworms of horses, cattle, sheep, rabbits, and allied animals.

Subfamily Mesocestoidinæ.

Diagnosis: Head with four suckers; segments distinct; genital pores in median ventral line. Type and only genus: *Mesocestoides* Vaillant, 1863.

Genus MESOCESTOIDES Vaillant, 1863.

(1885, *Ptychophysa* Hamann.)

Diagnosis: Char. of subfamily; a single egg sac present. Type species: *M. ambiguus* Vaillant, 1863.

Railliett (1893, p. 313) places Polonio's *Tænia imbutiformis* of wild geese in this genus as a *species inquirenda*, but I can not recognize Polonio's description and figure as supporting this view (vide p. 58). This genus would, therefore, according to my view, be without any representative among the parasites of domesticated birds. The type species *M. ambiguus* is found in *Gennetta gennetta* (Linné, 1758) [*Viverra genetta*], and one species, *M. lineatus* (Goeze, 1782) Railliett, 1893, is found in dogs and cats.

Subfamily Dipylidiinæ.

(1858, *Malacolepidota* Weinland—Soft-shell tapeworms; 1863, *Cystoideæ* Leuckart; *Cystoidei; Cystoidotæniæ; Tænia* (*Microtænia*).

Diagnosis: Head with 4 suckers; rostellum generally armed; genital pores lateral (marginal), single or double; egg with thin transparent shells, frequently arranged in egg sacs, in some cases scattered through the segments; larval stage a cysticercoid; adults in birds and mammals. Type genus: *Dipylidium* R. Leuckart, 1863.

Probably all of the *Tæniidæ* of birds belong to this subfamily, which is at present divided into nine genera. The tapeworms of domesticated fowls are confined to the five genera: *Cotugnia*, *Davainea*, *Dicranotænia*, *Drepanidotænia*, and *Echinocotyle.*

---

[1] Syn. 1858, Sclerolepidota Weinland (hard-shell tapeworms); *Cysticæ; Cystotæniæ.*

I. Genital pores double and opposite. Suckers unarmed.

Three different genera have been proposed in the subfamily *Dipylidiinæ* for forms with double and opposite genital pores, but they have been very poorly defined from one another.

The genus *Dipylidium* contains species which infest mammals, and with *D. caninum* as type species will unquestionably stand as a good genus. In birds several forms with double genital pores have also been described. *Tænia digonopora* Pasquale in chickens and *Tænia bifaria* Siebold in *Aythya nyroca* (*Nyroca leucophthalma*) have been placed by Diamare (1893A) in a new genus *Cotugnia*, which, however, he fails to define distinctly from *Dipylidium*, and which must unquestionably be suppressed unless better characters are brought to its support. Diamare (1893A) has also proposed the genus *Amabilia* for *Tænia lamelligera* in the flamingo (*Phœnicopterus antiquorum*).

Too little is known of the other forms described as possessing double genital pores to allow a determination of their generic affinities, and speculation in this direction would simply complicate matters; the forms which must be taken into consideration are *Tænia polymorpha* Rudolphi, 1819, pars (as determined by Krabbe 1869, p. 301) from *Recurvirostra avocetta* and "*Tænia lævis* Bloch (Diesing)" (see Krabbe, 1869, p. 302), from *Aythya ferina* [*Fuligula ferina*].

In deference to my Italian colleague Diamare, I adopt his genera provisionally, postponing final opinion in regard to them until his more detailed publication appears.

a. Two submedian ovaries in each segment.

a'. Hooks on rostellum arranged in several rows.

Genus **DIPYLIDIUM** R. Leuckart, 1863.[1]

(1858, *Alyselminthus* Zeder, 1800, partim Weinland.)

Diagnosis: Rostellum retractile, armed with several transverse rows of alternating hooks; hooks with small roots, the base being discoidal; mature segments elongate with double sets of genital organs; pores double and opposite; testicles very numerous, scattered through the median field; ovary bilobled; vitellogene glands distal; uterus at first reticulate among the testicles, finally resolving itself into independent egg sacs containing one or several ova; ova with double transparent membranes. Type species: *D. caninum* (Linné, 1767).

No members of this genus have as yet been recorded from birds. The type species *D. caninum* inhabits the intestine of dogs, cats, and man; its larval stage lives in fleas (*Pulex serraticeps P. irritans*) and lice (*Trichodectes canis*).

a''. Hooks on head arranged in a single row.

Genus **COTUGNIA** Diamare, 1893. (Gen. inq.).

Diagnosis: Head large, with a rudimentary retractile rostellum armed with a large number of very minute hooklets arranged in a single row, prong thick and short, without dorsal root, with ventral root thin and elongate toward the point. Suckers large and unarmed. Mature segments broader than long. Genital organs double, opening separately each on its respective lateral margin. Uterus composed of egg sacs. Type species: *Cotugnia digonopora* (Pasquale, 1890) Diamare, 1893.

---

[1] For full bibliography consult Diamare's monograph (1893) *Il Genere Dipylidium* Lkt. < Atti. R. Accad. Scienze fisiche e matematiche, Vol. VI, ser. 2*a*, No. 7, 31 pages, 3 plates. Care should, however, be exercised in accepting the dates given by Diamare as many typographical errors have crept into the bibliography.

This genus was established by Diamare for a tapeworm which occurs in chickens. The diagnosis as at present given by Diamare fails, in my opinion, to separate the genus distinctly from *Dipylidium*. Two species have been described, but insufficiency of details in the specific diagnoses does not allow a satisfactory morphological distinction at present.

{ Found in chickens ..... *C. digonopora.*
{ Found in ducks ..... *C. bifaria.*

3. Cotugnia digonopora (Pasquale, 1890) Diamare, 1893. The double-pored chicken tapeworm.

(1890, *Tænia digonopora* Pasquale.)

[Pl. I, figs. 1–11.]

Diagnosis: Strobila 40^{mm} to 80^{mm} long by 8^{mm} broad and in contracted condition about 1^{mm} thick; head 1.4^{mm} by 1.12^{mm}; rostellum with a crowded crown (in a single row) of very small hooks 8.35 μ long; base of rostellum 0.22^{mm} by 0.15^{mm}; suckers globular, prominent, 0.35^{mm} in diameter. Neck short. Anterior segments broader than long, posterior segments longer than broad. Genital pores double in about the middle of the lateral margins; 2 ovaries in each segment; eggs evidently arranged in egg sacs.

Life history: Unknown.

Host: Chicken (*Gallus domesticus*) by Pasquale.

Geographical distribution: Abyssinia, by Pasquale.

Pasquale (1890) found this worm quite common in chickens in Massowah and thinks it probable that the poor condition of the fowls was due to its presence. It was frequently present in the cæca as well as in the small intestine.

4. Cotugnia bifaria (von Siebold, 1848) Diamare, 1893. The double-pored duck tapeworm.

(1848, *Tænia bifaria* von Siebold; 1871, *T. tuberculata* Krefft [nec Rudolphi, 1819].)

[Pl. II, figs. 12–17.]

Diagnosis: Strobila 39^{mm} to 90^{mm} long by (?) broad. Head triangular, with conical, pointed, (?) unarmed rostellum and 4 small unarmed circular suckers; neck short. Proximal segments small, narrow, gradually enlarged, and rectangular; distal segments the largest, subquadrate. Genital pores double, one each side in about the middle of the margin, prominent in sexually active segments. *Male organs*: Testicles few in number; each vas deferens inflated into a vesicula seminalis near the anterior margin of the segment, somewhat laterally of the median line; from here the seminal canal runs diagonally to the cirrus pouch, which is large; cirrus covered with minute spines. *Female organs:* Not well understoood; evidently 2 ovaries present in the posterior portion of the segment, one each side of the median line.

Life history: Unknown.

Type specimen: Collection Siebold in British Museum.

Hosts: African Teal (*Aythya nyroca*), by von Siebold; White-eyed duck, *A. australis* (Gould), by Krefft.

Geographical distribution: ———— by von Siebold; Australia, by Krefft.

Von Siebold (1848, p. 147) mentions *Tænia bifaria* from the intestine of *Anas leucophthalmos* (= *Aythya nyroca*). The specimens possessed double genital pores

similar to *D. caninum*. Monticelli (1889, p. 325) examined these specimens, preserved in the British Museum, and gave a short diagnosis. In another paper (1891, pp. 151–153) he gives a more extended description, together with figures. He did not observe hooks on the head but will not deny their presence. Monticelli states that Krefft's species "*T. tubercolata*" (= *T. tuberculata*), described from *Aythya australis* (Gould), is identical with *T. bifaria*. Diamare (1893, p. 12) places *T. bifaria* in the genus *Cotugnia*.

b. One median ovary in each segment.

Genus **AMABILIA** Diamare, 1893. (Gen. inq.)

Diagnosis: Avian cestode with double lateral genital pores; double cirri; ovary single and median. Type species: *Amabilia lamelligera* (Owen, 1835) Diamare, 1893.

This genus was proposed recently in a preliminary communication by Diamare. A more complete knowledge of the worm is necessary before it will be possible to judge whether the genus is well founded or not. No member of the genus has yet been recorded in domesticated fowls, but the type and only species is found in the flamingo.

5. Amabilia lamelligera (Owen, 1835) Diamare, 1893.

(1835, *Tænia lamelligera* Owen.)

[Pl. II, figs. 18–20.]

Diagnosis: Strobila 120^{mm} to 170^{mm} long, 10.5^{mm} broad, 2.1^{mm} thick. Head almost globular; rostellum cylindrical, obtuse; armature? Neck absent; segments very short. Genital pores double; ovary single and median. Ova segregated near base of penis.

Hosts: Flamingo[1] (*Phœnicopterus antiquorum*).

Geographical distribution: ? by Sykes; France by Gervais; ? Sardinia (? Cagliari) by Ficalbi.

II. Genital pores single. Suckers armed or unarmed.

A. Suckers unarmed: genera *Hymenolepis, Dicranotænia,* and *Drepanidotænia.*

Genus **HYMENOLEPIS** Weinland, 1858.

(1858, *Diplacanthus* Weinland [nec L. Agassiz].)

Diagnosis: Strobila small (filiform). Head small, provided with a retractile rostellum, well developed and armed with a single crown of 24–30 hooklets, or rudimentary and unarmed. (Neck long. Segments serrate, much broader than long, rarely less than 150 in number.) Genital pores marginal, sinistral, the female surface of the proglottid representing ventral. Testicles few, generally 3 in each segment, one left and two right of the median line. Gravid segments transformed into a sac full of eggs; eggs surrounded by 3 shells separated one from another. Inner shell without pyriform body, but occasionally with a small knob at each pole. Larva is a

[1] Owen states that his specimens were collected by Lieutenant-Colonel Sykes "in a *Flamingo, Phœnicopterus ruber,* Linn." Diamare states that his own specimens were collected by "Professor Ficalbi, della R. Universita di Cagliari," from "*Phœnicopterus roseus.*" According to Dr. T. S. Palmer, the Old World flamingoes are *P. antiquorum* Temm. (syn. *P. roseus* Pallas), *P. erythræus,* and *P. minor;* the New World flamingoes are *P. ruber* Linn., and *P. ignipalliatus.* In Owen's time, however, all flamingoes were included under the name *P. ruber* Linn. As it was not stated where Sykes collected his material it is impossible to determine the host species definitely, but upon Dr. Palmer's advice I take *P. antiquorum* as host.

Cryptocystis or *Staphylocystis;* intermediate host an insect or myriapode. Type species: *H. diminuta* (Rud., 1819).

(Revised generic characters from Blanchard, 1891C, pp. 49–50. I inclose in brackets several characters which I can hardly look upon as generic. For bibliography see R. Blanchard, 1891C.)

Weinland proposed this genus with *Tænia flavopunctata* as type, but as this form is identical with *Tænia diminuta* the name *H. diminuta* is here inserted as type species. At the same time he proposed a genus *Diplacanthus* (nec L. Agassiz) with *Tænia nana* von Siebold as type species. The term *Diplacanthus* must drop, as it is preoccupied, and there seems to be no good grounds for separating *H. nana* generically from *H. diminuta.*

Weinland divided *Hymenolepis* into two subgenera: (1) *Lepidotrias* Weinland, 1858 (with 3 eggshells) with *H. murina* (Dujardin, 1845) Weinland, 1858, as type species, and including *Tænia scalaris, scutigera, tiara, pistillum, microstoma, nasuta, undulata, serpentulus, crateriformis, sinuosa* and *flavopunctata;* (2) *Dilepis* Weinland, 1858 (with 2 eggshells), with *T. angulata* Rud. as type species, and containing *T. purpurata, porosa* and *lanceolata.* Of these forms *T. sinuosa* (vide *Drepanidotænia sinuosa* p. 40) and *T. lanceolata* (vide *Dr. lanceolata* p. 36) occur in domestic fowls.

Most of the species of this genus are parasitic in mammals, but Weinland included a number of avian tapeworms in *Hymenolepis.* Blanchard (1891C, pp. 68–69) discusses the forms and concludes that only four avian species can be included here with any degree of probability. These species mentioned below do not occur in domesticated fowls.

Hymenolepis serpentulus (Schrank, 1798) Weinland, 1858. (Syn. 1798, *Tænia serpentulus* Schrank [nec Duj., 1845]), found in *Oriolus galbula, Corvus cornix, C. corone, C. frugilegus, C. monedula, Nucifraga caryocatactes, Garrulus glandarius, Pica caudata, Picus aurulentus.*

Hymenolepis angulata (Rud., 1810) Weinland, 1858. (Syn. 1810, *Tænia angulata* Rud.; 1845, *T. serpentulus* Duj. [nec Schrank, 1798]); found in *Nucifraga caryocatactes, Turdus atrigularis, T. iliacus, T. merula, T. musicus, T. pilaris, T. saxatilis, T. torquatus, T. viscivorus, Oriolus galbula, Pica caudata.*

Hymenolepis nasuta (Rud., 1802), Weinland, 1858. (Syn. 1802, *Tænia nasuta* Rudolphi); found in *Parus major, P. caudatus, P. cœruleus, P. cristatus, P. palustris.*

Hymenolepis farciminalis (Batsch, 1786), R. Bl., 1891. (Syn. 1786, *Tænia farciminalis* Batsch; 1845, *T. undulata* Duj.); found in *Sturnus vulgaris, Garrulus glandarius.*

Genus **DICRANOTÆNIA** Railliet, 1892.

Diagnosis: Rostellum provided with a single row of short, uniform hooks, generally few (10–26) in number, with the ventral root equal to or longer than the dorsal root, and forming with the prong a small pitchfork. Type species: *Dicranotænia coronula* (Dujardin) Railliet.

Development: The larval cysticercoids develop in small crustaceans.

From the characters thus far given it is very difficult to distinguish this genus from *Hymenolepis.*

1	Genital pores alternate; rostellum with 12 hooks 32 μ long; found in chickens	*D. sphenoides*, p. 35
	Genital pores unilateral	2
2	Rostellum with 18 to 26 hooks 13 μ to 17 μ long; found in ducks	*D. coronula*, p. 33
	Rostellum with 10 hooks	3
3	Hooks 27 μ to 32 μ long; found in swans and big scaup duck	*D. æquabilis*, p. 33
	Hooks 47 μ to 66 μ long; found in wild ducks	*D. furcigera*, p. 34

a. Genital pores unilateral.

6. Dicranotænia coronula (Dujardin, 1845) Railliet, 1892.

(1845, *Tænia coronula* Duj.)

[Pl. III, figs. 21–28.]

Diagnosis: 120mm to 190mm long, 1.5mm to 3mm broad. Head almost rhomboidal, 0.20mm to 0.22mm; suckers prominent, angular, irregular, 0.066mm to 0.09mm in diameter; rostellum thick, 0.09mm by 0.06mm, surrounded by a simple crown of 18–26 hooks 9 μ to 14 μ (Dujardin), 14 μ to 15 μ (Krabbe), 13 μ to 17 μ (Railliet) long. Anterior segments very short; following segments gradually increase in size. Genital pores unilateral. Penis 60 μ to 80 μ (Duj.) 110 μ (Krabbe) long by 30 μ to 53 μ broad, but able to swell to 80 μ, covered with minute spines. Hooks of embryo 8 μ. Internal anatomy?

Development: Cysticercoid, probably in mussel crabs (*Cypris ovum* Jur., *Cypris cinerea, Cypria ophthalmica* Jur. and *Candona candida.*

Hosts: Tame ducks (*Anas boschas dom.*); Mallard duck (*A. boschas* L.); European Golden Eye (*Glaucionetta clangula*).

Geographical distribution: France (at Rennes, by Dujardin; at Alfort, by Railliet); Denmark (in Zealand by Krabbe); Germany (in Bavaria by von Siebold, after Krabbe; in Munich by von Willemoes-Suhm, after Krabbe, 1882). No epidemics reported.

Dujardin (1845, p. 574) described this species from parasites found in ducks at Rennes; Krabbe (1869, pp. 317–318) found the same species in domesticated ducks and adds a few observations, chiefly measurements; he cites it from Siebold's collection (from *Glancionetta clangula*) and in 1882, p. 356, cites it from von Willemoes-Suhm (from *Anas boschas fera*). Railliet (1893, p. 303) has found young tapeworms in the domesticated duck at Alfort, which he determined as belonging to this species, although the dorsal root of the hooks were much more slender than those figured by Krabbe. These appear to be the only observations upon the adult worm, which as at present diagnosed, is based entirely upon external characters, and which, therefore, should be restudied anatomically.

Several authors have found larval cestodes in fresh-water mussel crabs which they look upon as the young stage of *Dicr. coronula.*

Mrázek (1890) [in a publication which on account of the language I am unable to read, I quote from Moniez (1891, p. 26) and Railliet (1893)] has found a cysticercoid in *Cypris ovum* Jur. and in *Cypris ophthalmica* Jur. (*Cypris compressa* Baird) which measures 140 μ to 190 μ in diameter, and is provided with 22 to 31 hooks corresponding in form and dimensions to those figured by Krabbe, except that the dorsal root is somewhat more slender; the tail is 3 to 5 times as long as the body and bears the 6 hooks (8 μ long) of the oncosphere. Rosseter (1890) describes and figures the cysticercoid of *D. coronula* from *Cypris cinerea* in Kent. Moniez (1891, p. 26) states that this cysticercoid is rather common in France, where he has found it in *Cypria ophthalmica* and *Candona candida;* he also records it in *Cy. ophthalmica* from Durham and from China.

While it will be noticed that this cysticercoid is very similar to *Dicr. coronula* and that in all probability it represents its larval stage, it must not be forgotten that the experimental proof of the relationship of these organisms has not yet been forthcoming, and furthermore, that even the adult form is very superficially described.

7. Dicranotænia æquabilis (Rudolphi, 1810) Railliet, 1893.

(1810, *Tænia æquabilis* Rudolphi.)

[Pl. III, figs. 29–30.]

Diagnosis: 160mm to 350mm long, 3.2mm to 4.6mm broad. Head subglobular; rostellum obovate, armed with a simple crown of 10 hooks 27 μ to 32 μ long; suckers rather large, orbicular, prominent. Neck very short. Anterior segments very short and

thin; following segments trapezoidal, much broader than long, posterior angles acute, but becoming more rounded near the posterior end. Genital pores unilateral. Development unknown.

Hosts: European swan (*Olor cygnus*); ? domesticated swan (*O. cygnus dom.*); Widgeon (*Anas penelope*); European scaup duck (*Aythya marila*).

Geographical distribution: Pomerania (by Rudolphi and Creplin); Schleswig (by Friis). Epidemics: None reported.

Like the preceding species, this form has been seen but a few times and is established entirely upon external characters.

Rudolphi collected it originally and described it in 1810 (pp. 135–136) from wild swan. In 1819 (p. 155) he gives "*Anas olor*" as a host. According to Diesing (1850, p. 527) Bremser found it in *Olor cygnus*. Bellingham (1844, p. 320) quotes it for "*Cygnus ferus* and *Mareca penelope*." Krabbe (1869, pp. 316–317) examined the originals and figured the hooks; he cites it further from Creplin's collection, and mentions that Friis also found it. "Gervais and van Beneden, afterwards von Linstow, cite it, probably erroneously, from the domesticated swan" (Railliet). Von Linstow (1878, p. 158) records it for *Fuligula marila* (= *Aythya marila*), but does not give the collector.

8. Dicranotænia furcigera (Rudolphi, 1819) Stiles, 1896.

(1819, "*T. trilineata* Batsch" of Rudolphi; 1819, T. *furcigera* Rudolphi ex Nitzsch, MS.; 1845, *T. rhomboidea* Duj.; 1893, *Dicranotænia rhomboidea* (Dujardin, 1845) Railliet.)
(? 1779, *Tænia lineata* Bloch; ? 1786, *T. trilineata* Batsch; ? 1790, *T. Anatis* β *lineata* Gmelin; ? 1802, *T. longirostris* Frölich [nec Rud., 1819]; ? 1803, *Halysis trilineata* (Batsch, 1786) Zeder; ? 1858, *T. conica* Molin.)

[Pl. III, figs. 31–34 (35–36).]

Diagnosis: 10^{mm} to 35^{mm} long by 0.5 to 1^{mm} broad. Head 0.46^{mm} to 0.52, rhomboidal, or prolonged anteriorily in a tube containing a thick ovoide, oblong, rostellum 0.22^{mm} to 0.25^{mm} broad by 0.27^{mm} long, armed with a single crown of hooks 65 μ to 66 μ (Dujardin), 48 μ to 58 μ (Krabbe) long. Suckers 0.18^{mm} in diameter. Segments trapezoidal, 2 to 3 times longer than broad. Genital pores unilateral. Penis 9.7 μ broad, smooth. Embryo 36 μ; hooks of embryo 14 μ (Krabbe), 16 μ to 17 μ (Dujardin). Development not known.

Hosts: Mallard ducks (*Anas boschas*) by Dujardin, Nitzch, Krabbe, Friis; Pochard (*Aythya ferina*); is erroneously stated to have been found in domestic ducks, according to Railliet. See also hosts for *T. conica, T. lineata,* and *T. trilineata,* in chart at end of text, taken from von Linstow, 1878, and others.

Geographical distribution: France (by Dujardin), Italy (by de Ninni), Iceland (Krabbe), Schleswig (Friis). Epidemics, none recorded.

The early history of this worm is buried under indefinite and incomplete statements upon superficially studied material. We can, however, trace the species with certainty as far back as Rudolphi, 1819, p. 528. Nitzsch collected some worms from the Mallard in 1816, and sent them to Rudolphi, evidently under the MS. label *Tænia furcigera.* Rudolphi determined the worms as *T. trilineata* Batsch, 1786, which, according to Krabbe (1869, p. 315) (Batsch's original not at my disposal), is a name Batsch introduced for Bloch's *T. lineata* of 1779. Krabbe afterward examined Nitzsch's specimens, and states (1869, p. 315) that they are identical with *T. rhomboidea* Dujardin, 1845. I adopt Nitzsch's name for the reasons given in the footnote.[1]

[1] A very delicate point of nomenclature is involved in this case, and one which has been entirely overlooked by helminthologists. In the first place, the name *trilineata* should be suppressed because (Krabbe, 1869, p. 315) it was originally intended for a species (i. e., *T. lineata* from *A. penelope, A. circia, Dafila acuta*) already named

Dujardin (1845, pp. 574–575, *T. rhomboidea*) found a 30mm fragment and 6 young worms 10mm to 18mm long in a wild duck, in which "*Tænia megalops*" was also present. In Iceland Krabbe collected numerous young specimens of *T. rhomboidea* from wild ducks (*A. boschas fera*); they were 10mm long by 0.5mm broad; the rostellum was armed with 10 hooks, 47 μ to 58 μ long; genital apparatus not visible. Friis (Krabbe, 1869) collected the same species in Schleswig, and Krabbe thinks that the worm which Molin (1858, p. 139; 1861, p. 253, Taf. VII, figs. 1–2) found in wild ducks in Padua and described under the name *T. conica* is also identical with Dujardin's *T. rhomboidea*. Molin records his form from *Anas boschas;* von Linstow (1878) gives it for *A. boschas dom.*, but not for *A. boschas*. Railliet (1893, p. 303) places *T. rhomboidea* in the genus *Dicranotænia*, and calls attention to the error in Diesing (1850, p. 543) of including *T. trilineata* as a parasite of the domestic duck—an error repeated by von Linstow. Railliet thinks that *T. trilineata* Batsch, 1786, is identical with *T. rhomboidea*, although Dujardin (1845) thinks that *T. trilineata* is simply a variety of *T. sinuosa*.

There seems no way either to prove or disprove what species *T. trilineata* Batsch (= *T. lineata* Bloch) really represents, unless the types can be procured. In view of the poor descriptions I intend for the present to ignore these specific names entirely.

b. Genital pores alternate.

9. Dicranotænia sphenoides (Railliet, 1892) Railliet, 1896.

(1872, *Tænia cuneata* von Linstow [nec Batsch, 1786]; 1892, *T. sphenoides* Raill.; 1893, *Dicranotænia cuneata* (von Linstow, 1872) Raill.)

[Pl. IV, figs. 37–42.]

Diagnosis: Body 2mm (von Linstow) to 4mm (Magalhães) long, by 1mm broad, wedge-shaped; head 200 μ long by 205 μ broad, contracted posteriorly to form the neck; retractile rostellum cylindrical, 150 μ long by 37.5 μ broad, bearing 12 (von Linstow, Magalhães, Piana) or 12–14 (Grassi & Rovelli) hooks which measure 25 μ (Magalhães) or 32 μ (other authors) long; dorsal root of hooks short and same length as ventral root. Suckers round to oval, 75 μ in diameter, unarmed. Segments 12–13 in number, increasing gradually in size from the first to the last, so that the entire body is wedge-shaped. Genital pores irregularly alternate, situated at the anterior angle of the segments; male organs appear in first segment, testicles "numerous," vitellaria seen in ninth and following segments; mature eggs seen only in twelfth and thirteenth segments; they lie in 12–13 large vesicles which finally break, the eggs being scattered through the segments. Eggs spherical, 42 μ in diameter, with 2 membranes; hooks of oncosphere, 6 μ.

Development: Intermediate host is probably an earthworm (*Allobophora fœtida* Eisen). The cysticercoid has no tail.

Host: Chickens (*Gallus domesticus*).

Geographical distribution: Germany (von Linstow); Italy (Grassi & Rovelli); South America—Brazil (Magalhães).

---

and figured. Accordingly, *trilineata* should never have been proposed, and hence can not be taken into consideration under any circumstances. Krabbe states that the description and figures of *T. lineata* are so imperfect that it is not possible to determine the species with certainty, although from Bloch's figures it is not probable that his worm is identical with *T. rhomboidea*. This statement relieves us from considering *T. lineata* further unless Bloch's specimens can be found. Authors have generally accepted Dujardin's specific name, but the publication of Nitzsch's name by Rudolphi establishes the date of *T. furcigera* as 1819, and associates the name with Rudolphi's description. Krabbe's establishment of the identity of *T. rhomboidea* with *T. furcigera* must naturally suppress Dujardin's name. Accordingly, Nitzsch's specimens are the oldest types as yet consulted, and nothing remains at present but to accept Rudolphi's publication of this name.

Von Linstow (1872B, pp. 56–57) discovered this worm in chickens in Germany, and described it as *Tænia cuneata*. Piana (1882, p. 393–394) evidently examined some of von Linstow's originals, but does not add much to the diagnosis. Grassi & Rovelli (1889A, p. 404; 1892, pp. 29–30, 88–90) found the same species in Italy; they found some cysticercoids in an earthworm (*Allobophora fœtida*), which they believe represent the larval stage of *T. cuneata*. They evidently, however, did not make any experiments to determine this point, although they state that the hooks agree with the hooks of *T. cuneata*. This supposed intermediate host must therefore be subjected to experimentation before Grassi & Rovelli's statements are given full credence. Magalhães (1892, pp. 145–146) records the same species from Brazil, adding several important points on the anatomy of the worm. Railliet (1892, p. 53) uses the term *Tænia sphenoides* for this worm, his ground evidently being that the term *T. cuneata* is already preoccupied. In 1893 (p. 304) he reverts to the specific name *cuneata*, placing the form in *Dicranotænia*. By the international rules the term *cuneata* must fall, on which account I accept the next available name, *sphenoides*. (See addendum, p. 61.)

Genus **DREPANIDOTÆNIA** Railliet, 1892.

Diagnosis: Head provided with a single row of uniform hooks, few (8–20) in number, with dorsal root much longer than ventral root, the latter always small; with prong directed posteriorly when the rostellum contracts. Type species *Dr. lanceolata* (Bloch, 1782) Railliet 1892.

Development: The larval stage (cysticercoid) of several species has been found in small crustaceans.

1. Genital pores alternate; rostellum with 16–20 hooks 20–27 μ long; Hab: chickens, ? pheasants, ? ducks, pigeons ..... *Dr. infundibuliformis*, p. 43
   Genital pores unilateral 2
2. Rostellum with 10 hooks 3
   Rostellum with 8 hooks 4
3. Hooks 20 μ to 23 μ long; found in ducks, domestic goose, and wild goosander ..... *Dr. tenuirostris*, p. 43
   Hooks 35 μ to 40 μ long; found in geese ..... *Dr. setigera*, p. 41
   Hooks 51 μ to 61 μ long; found in geese ..... *Dr. sinuosa*, p. 40
   Hooks 65 μ to 72 μ long; found in ducks ..... *Dr. anatina*, p. 39
4. Hooks 31 μ to 35 μ long; found in ducks and geese ..... *Dr. lanceolata*, p. 36
   Hooks 57 μ long; found in geese ..... *Dr. fasciata*, p. 37
   Hooks 77 μ to 80 μ long; found in ducks and geese ..... *Dr. gracilis*, p. 38

A. Genital pore unilateral.

a. Rostellum with 8 hooks.

10. Drepanidotænia lanceolata (Bloch, 1782) Railliet, 1892. The lanceolate tapeworm.

(1727, *Tænia anserum* Frisch—vide Rud., 1810; 1781, *T. acutissima* Pallas, pars—vide Krabbe, 1869; 1779, *T. anseris* Bloch—vide Rud., 1810; 1782, *T. lanceolata* Bloch; 1786, *T. lanceola* Batsch—vide Rud., 1810; 1803, *Halysis lanceolata* (Bloch, 1782) Zeder—vide Rud., 1810; 1858, *Hymenolepis* (*Dilepis*) *lanceolata* (Bloch, 1782) Weinland.)

[Pl. IV, Figs. 43–53; Pl. V, Figs. 54–55.]

Diagnosis: 30^{mm} to 130^{mm} long by 5^{mm} to 18^{mm} broad. Head very small, globular; rostellum cylindrical, slightly swollen on the summit, armed with a single crown of 8 hooks 31 μ to 35 μ long; suckers rounded. Neck very short, can be retracted with the head into the anterior portion of the strobila. Anterior segments very short, the following segments increasing slightly in length and becoming gradually broader to within a short distance of the posterior extremity when they become

narrower, giving the body a lancet shape. Genital pores unilateral, near anterior corner of segment; penis armed with spines; cirrus-pouch small; testicles 3; female organs on opposite side of segment from genital pore (Feuereisen). Eggs with very thin external shell 50 μ by 35 μ; hooks of oncosphere 8 μ. Development: Unknown.

Hosts: Tame duck (*Anas boschas dom.*); black duck (*Anas obscura*); tame goose (*Anser anser dom.*); muscovy duck (*Cairina moschata*); white-headed duck (*Erismatura leucocephala*); pochard (*Aythya ferina*); African teal (*Aythya nyroca*); red-crested pochard (*Aythya rufina*); flamingo (*Phœnicopterus antiquorum*).

Geographical distribution: England, Denmark, France, Germany, and Austria. Epidemic in 1710, reported by Frisch.

Bloch (1782, p. 7–9) found this worm more especially among lean geese; Goeze (1782, pp. 377–383) says that it is most common in lean geese which have been allowed to roam; Dujardin (1845, p. 562) mentions *T. lanceolata* as possessing 10 hooks and irregularly alternating genital pores, which makes it probable that he did not have this species before him. Krabbe (1869, pp. 295–296) found this form in 77 geese out of 400 examined, or about 20 per cent. The Vienna catalogue gives *T. lanceolata* and *T. sinuosa* together for 19 out of 139 tame geese. The epidemic of 1710 recorded by Frisch (1727; 1781, pp. 155–156) is attributed to this species. It has been found by various German authors. Mégnin (1881A, pp. 29–32) has found it in ducks and geese in France, Railliet (1893, pp. 299–300) in Ardennes France, Lucet in Loiret, France. Railliet states that this is the most common form in geese. Hassall has one specimen from Liverpool, England.

Authors generally consider that there is little or no difficulty in recognizing this species, its anatomy, however, is very imperfectly understood.

11. Drepanidotænia fasciata ([? Rudolphi, 1810] Krabbe, 1869) Railliet, 1893. (1868, "*T. setigera* Frölich," 1789 of Feuereisen [nec Frölich of v. Siebold, 1848]; 1869, *T. fasciata* Krabbe.)

(? 1800, *Alyselminthus crenatus* (Goeze, 1782) Zeder pars—vide Rud., 1810; ? 1803, *Halysis crenata* (Goeze, 1782) Zeder pars—vide Rud., 1810; ? 1810, *Tœnia fasciata* Rud.).

[Pl. V, figs. 56–66; Pl. VI, figs. 67–76; Pl. VII. figs. 77–79.]

Diagnosis: Body 60^{mm} to 160^{mm} long by 1^{mm} to 2^{mm} broad. Head hemispherical, compressed, 0.35^{mm} broad by 0.25^{mm} long; suckers oval, 0.14^{mm} long by 0.13^{mm} (posterior) to 0.06^{mm} (anterior) broad; rostellum long, thick, cylindrical, 0.26^{mm} by 0.05^{mm}, armed on anterior end with simple crown of 8 hooks 57 μ to 60 μ long, roots of about equal length. Neck very long, much thinner than the head. Segments much broader than long; anterior segments 5 times as broad as long; posterior segments 3 times as broad as long, and somewhat funnel shaped; segments become 0.25^{mm} thick; thickness especially in the median line, which is traversed by a dark longitudinal band; thinner and more transparent toward the border; straighter at the angles, the strobila having a crenate appearance. Genital pores unilateral in anterior half of margin. Calcareous bodies absent from the head, but present in the neck and increase distally. *Male organs* begin to develop in ca. one hundred and twentieth segment; 3 testicles present in distal portion of segment, one median, two lateral; vas deferens runs diagonally toward proximal aporose corner of segment, swelling into a vesicula seminalis; near lateral margin it turns, runs parallel to anterior margin and leads to cirrus pouch, which also runs parallel to anterior margin of segment; cirrus pouch lies on aporose side of median line and contains a second vesicula seminalis, which communicates with a very long cirrus; genital cloaca 0.2^{mm} to 0.3^{mm} long by 0.03^{mm} to 0.09^{mm} broad, the broader portion being next to genital pore; a row of spines at the point where the penis opens into the cloaca; penis covered with minute spines. *Female organs* not well understood; begin in ca. one hundred and forty-fifth segment; a median oval body and two lateral lobed bodies joined together;

a median receptaculum seminis runs cephalad and diagonally, continues as vagina, which runs parallel to anterior margin nearly entire breadth of segment, and opens into cloaca near cirrus; a second larger lobed body = ? uterus.

Development: *Cercocystis Dr. fasciatæ* in *Cyclops agilis*, recorded by Mrázek.

Hosts: White-fronted goose (*Anser albifrons*); graylag goose (*A. anser*); tame goose (*A. anser dom.*).

Geographical distribution: Denmark (by Krabbe); Germany (by Feuereisen); Bohemia (by Mrázek).

Zeder referred a tapeworm which he had found in a goose to *T. crenata* Goeze, which was reported from *Picus major* (see Krabbe, 1869, p. 300). Rudolphi (1810, pp. 139–140) renamed the species *fasciata*, but does not appear to have examined it. Feuereisen (1868, pp. 162–190) then determined von Siebold's *T. fasciata* Rud. as *T. setigera* Frölich, 1789, and the year following Krabbe (1869, p. 300), stating that it was impossible to recognize definitely what goose tapeworm was included under the specific name *fasciata* by earlier authors, proposed to apply the name to a worm in geese provided with 8 hooks on the rostellum. Authors have since Krabbe's time adopted his form as *fasciata*. I retain this name provisionally, although it has no right to stand.

Mrázek (1890, 1891) records a cysticercoid from *Cypris agilis* which he identifies as the larval stage of *Tænia fasciata* Rudolphi. He evidently made no infections.

12. Drepanidotænia gracilis ([?Zeder, 1803] Krabbe, 1869) Railliet, 1893.

(1869, *Tænia gracilis* Krabbe.)

(? 1782, *Tænia collo longissimo* Bloch; ? 1803, *Halysis gracilis* Zeder; ? 1810, *T. gracilis* (Zeder) Rud.)

[Pl. VII, figs. 80–91; Pl. VIII, figs. 92–99.]

Diagnosis: About 270^{mm} long by 1.5–2^{mm} broad. Head subglobular; rostellum cylindrical, obtuse, armed with a simple crown of 8 hooks 77–80 μ long (95 μ and even 103 μ after Lönnberg). Neck very short. Anterior portion of body very thin for a considerable length; anterior segments infundibuliform, the following segments gradually becoming quadrate, genital pores unilateral. Receptaculum seminis pyriform; penis unarmed; genital sinus provided with large spines.

Development: *Cercocystis Dr. gracilis* in *Candona rostrata* by Scott, in *Cypris compressa* Baird (*Cypria ophthalmica* Jurine) and *Cyclops viridis* Fischer by Mrázek, in *Cypria ophthalmica* by Moniez.

Hosts: Tame duck (*Anas boschas dom.*); mallard duck (*A. boschas*); widgeon (*Anas penelope*); tame goose (*Anser anser dom.*); goosander (*Merganser merganser*); red-breasted merganser (*Merganser serrator*); common sheldrake (*Tadorna tadorna*).

Geographical distribution: Denmark, Germany. No epidemics recorded.

It is impossible to tell what worm was referred to under the specific term *gracilis* before Krabbe's time; the earlier descriptions may therefore be ignored for the present, the names being accepted as unidentifiable synonyms; it is impossible to show that the earlier worms were not identical with Krabbe's form from *Anas boschas dom.* The only positively known host for the adult up to Krabbe's time is, therefore, the tame duck.

Von Linstow (1872A, pp. 535–537) afterwards found a worm in the goosander (*Merganser merganser* [*Mergus merganser*]) which he identified with Krabbe's species. Lönnberg (1889, pp. 9–10, fig. 1) found a worm in *Tadorna vulpanser* which he described as a new variety: *T. gracilis* forma *Tadornæ*. The hooks on this worm were much larger than those of the type specimen, a variation which Lönnberg explains as due to host influence. Lönnberg (1890, pp. 10, 30) also records this form for *Mergus serrator* (= *Merganser serrator*).

Von Linstow (1872 A, pp. 535–537) found a cysticercoid measuring 0.14 by 0.09^{mm} in intestine of a perch (*Perca fluviatilis*), which he looked upon as the young of *Tænia gracilis*. The larva has also been found in certain fresh-water crustaceans which probably represent the regular intermediate host. Thus Scott (1891, p. 314) noticed an object in a mounted slide of *Candona rostrata* Brady & Norman, from the Edinburg district; Blanchard (1891A, pp. 330–332) examined Scott's preparation from *Candona rostrata*, and after a careful comparison of the hooks of the cysticercoid concluded that this larva belonged in the life cycle of *Tænia gracilis*. He explains von Linstow's finding this same larva in a perch by the fact that the fish had eaten some ostracodes. He introduces the formula—the length $= a - c$, the base $= a - b$, in measuring the hooks, using it as follows: For *T. gracilis* $ab : ac = 30–75$. Mrázek (1891, p. 128) cites the larva for *Cypris compressa* Baird and *Cyclops viridis* Fisch, while Moniez (1891, p. 26) mentions it from *Cypria ophthalmica* from China.

The larva referred to is in all probability the true larva of this species, but no infections have as yet been made.

b. Rostellum with 10 hooks.

13. Drepanidotænia anatina (Krabbe, 1869) Railliet, 1893.

(1869, *Tænia anatina* Krabbe.)

[Pl. IX, figs. 100–111; Pl. X, figs. 112–115.]

Diagnosis: Strobila attains 200^{mm} to 300^{mm} in length and 2^{mm} to 3^{mm} in breadth; worm of 70^{mm} in length has about 650 segments; number of segments in longest worms probably reaches 2,000. Head with a simple crown of 10 hooks 65 μ–72 μ long. Neck long. Fully matured segments half as thick as broad. Genital pores unilateral; copulation begins with about the five hundredth segment, uterus appears ca. 70 segments later. *Male organs:* Testicles 3 in number, one on pore side, two on aporose side of segment; cirrus pouch dorsal of vagina, elongate, extending to or slightly beyond the longitudinal canals, and possessing vesicula seminalis in its proximal portion; vas deferens swollen to an elongate vesicula seminalis near the pore-side testicle. *Female organs:* Vagina slightly longer than cirrus pouch, swelling into an enormous receptaculum seminis ventral of pore-side testicle; ovary large, about in median line; vitellogene gland distal of ovary; shell gland very small, dorso-proximal of vitellogene gland; uterus transverse, extending beyond longitudinal canals into the lateral field. Ova very characteristic; elongate 125 μ–175 μ by 90 μ with 3 shells; external shell thin and transparent, inner shell slightly constricted at lateral borders of the oncosphere; oncosphere elongate, 50 μ–60 μ, hooks 10 μ–11 μ. Dorsal canal small, dorsal of ventral canal; genital canals pass dorsally of dorsal and ventral canals.

Larval stage: Cysticercoid develops in small mussel crabs (*Cypris incongruens* Ramd.; *Cypris ovata; Cypris compressa*), and consists of three portions: (1) Scolex with (*a*) armed rostellum and 2 rostellum sacs, (*b*) four suckers provided with very minute cuticular hooklets (Schmidt), and (*c*) long, narrow neck provided with 30–40 calcareous corpuscles; (2) a hollow cyst or sac, composed of three layers; (3) a long, thin tail, in which the 6 hooks of the oncosphere are visible. The excretory system can be traced from the suckers to the end of the tail, where it ends in a terminal vesicle. Extended, the entire body may measure ca. 2^{mm}, the tail being 3½ to 4 times as long as the cyst. The scolex is contracted into the cyst, which then measures 0.19^{mm} to 0.20^{mm} by 0.21^{mm} to 0.23^{mm}, tail 0.7^{mm} to 0.8^{mm}.

Host: Domesticated duck (*Anas boschas dom.*); mallard (*A. boschas*); pintail (*Dafila acuta*).

Geographical distribution: Pomerania, by Creplin; Zealand (Denmark), by Gad and Krabbe; Schleswig, by Friis; France, by Moniez; Germany, by Schmidt. No epidemics recorded.

Krabbe (1869, pp. 287–288) found some specimens in Creplin's collections under the label *Tænia lævis* Bloch, collected from tame ducks. These worms agreed with others of Creplin's collection labeled *sinuosa*, from the same host, and with a third lot of worms from Gurlt's collection labeled "*Tænia porposa? Anas boschas fera*," the latter being in a bottle with others which appeared to be *T. rhomboidea*. Friis found the same worm in wild ducks in Schleswig, and Gad and Krabbe found it in tame ducks in Zealand. The worm was found three times in 100 tame ducks. Krabbe (1882, p. 353) states that Professor Reinhardt found this same species in 1874 in *Anas acuta* [=*Dafila acuta*] taken in Zealand.

Mrázek (1891, pp. 110–113) describes a cysticercoid which he found in Bohemia in *Cypris incongruens* and *Cypris compressa* Baird (according to Moniez, 1891, *Cypria ophthalmica*); the larva measured 0.40^{mm} to 0.43^{mm}, and bore 10 hooks 65 μ long; the tail was very long; embryonic hooks measured 10 μ. Moniez (1891, p. 26) states that he found the same larva in *Cypris incongruens* at Lille, France, and that the species *T. anatina* is the most common tapeworm of domesticated ducks of that country.

It is to J. E. Schmidt (1894) that we owe our chief knowledge of this worm and the experimental demonstration of its life history. Schmidt infected numerous small 2.25^{mm} to 2.75^{mm} fresh-water crustaceans (*Cypris ovata*) with the eggs of adult animals taken from ducks, and followed the development in all its stages. He found that the ova are eaten by *Cypris;* the embryo escapes from its shells and passes into the body cavity of the intermediate host; here it grows into a roundish hollow ball which gradually elongates and develops the various organs of the cysticercoid; when the organs are formed, the larva retracts its scolex into its cyst. In summer the entire development of the cysticercoid lasts but two weeks, while in winter it lasts over five weeks.

Ducks naturally become infected by swallowing the mussel crabs.

14. Drepanidotænia sinuosa (Zeder, 1800) Railliet, 1893.

(1782, *Tænia collari nigro* Bloch—vide Rud., 1810; 1782, *T. infundibuliformis* (Anserum) Goeze—vide Dies., 1850; 1786, *T. collaris* Batsch—vide Rud., 1810; 1790, *T. torquata* Gmelin—vide Rud., 1810; 1800, *Alyselmínthus sinuosus* Zeder; 1800, *Tænia breviarticulata* Goeze; 1803, *Halysis sinuosa* (Zeder, 1800) Zeder; 1803, *H. torquata* (Gmelin, 1790) Zeder—vide Rud., 1810; 1858, *Hymenolepis* (*Lepidotrias*) *sinuosa* (Zeder, 1800) Weinland).

[Pl. X, figs. 116–124; Pl. XI, figs. 125–139; Pl. XII, figs. 140–146; Pl. XIII, fig. 153.]

Diagnosis: 50^{mm} to 160^{mm} long by 1^{mm} to 2^{mm} broad. Head almost globular, rostellum armed with a simple row of 10 hooks 51 μ to 61 μ long. Neck very long. Anterior segments of variable breadth and length; the following segments trapezoidal; posterior segments rounded. Genital pores unilateral, situated toward the anterior third of the lateral margin; in each pore is found a globular sac, armed with spines, and appearing as a black point; this punctate line allows an immediate determination of the species. Eggs with 3 envelopes, the exterior 42 μ to 44 μ; hooks of oncosphere 7 μ to 8 μ.

Development: Cercocystis Dr. sinuosæ found in *Gammarus pulex* by Hamann and von Linstow; in *Cyclops viridis* Fisch, *C. agilis* Koch and *C. lucidulus* Koch, by Mrázek.

Hosts: Tame ducks (*Anas boschas dom.*); mallard duck (*A. boschas*); Brazilian teal (*A. braziliensis*); tame goose (*Anser anser dom.*); graylag goose (*A. anser*); pintail (*Dafila acuta*); tufted duck (*Aythya fuligula*).

Geographical distribution: France, Germany, Italy, Sweden, and Bohemia.

The species *sinuosa* as at present adopted by authors stands on a most peculiar footing.

Goeze left a description and figures of this worm, with the MS. name *Tænia breviarticulata*, from *Anas fusca*, which were later published by Zeder (1800, pp. 295–298) under *Alyselminthus sinuosus*. According to Krabbe (1869, p. 298) Rudolphi determined as *sinuosa* forms which differ greatly from one another. Dujardin (1845, p. 573) then gave a more exact description of a form which he determined as *T. sinuosa* (Zeder) Rud., taken from *Anas acuta*, adopting Rudolphi's synonymy in all essentials. Krabbe (1869, pp. 298–299) adopted Dujardin's determination of Zeder-Rudolphi's species, but ignored synonymy prior to Zeder. Thus we have no way of knowing whether the form now named *sinuosa* is identical with the original *sinuosa* or not, and Dujardin is the earliest author to whom we can trace the present *sinuosa* with any degree of certainty. Authors generally follow Krabbe in accepting Dujardin's determination of Zeder's *sinuosa* and it will be well at present to adopt this plan.

The views concerning the life history of this worm rest upon observations by Hamann, Mrázek, and von Linstow. Hamann (1889, pp. 1–7, Taf. I) found some cysticercoids in *Gammarus pulex* which von Linstow determined as the young of *T. sinuosa*. They were oval to spherical; tail surrounds body as a yellowish border; 6 oncospheric hooks, 13 μ long, persistent, one pair at end, one in middle, and one at beginning of tail; tail 0.5^{mm}, body with tail 1.3^{mm} long; hooks of cysticercoid 50 μ long, 10 in number; calcareous bodies numerous, 6 μ in diameter, oval. Mrázek found a cysticercoid in Bohemia, 0.23^{mm} long; tail moderately long, oncospheric hooks 11 μ; 50 calcareous corpuscles present. He identified this organism with Hamann's larval form, and records it from *Cyclops viridis* Fisch, *C. agilis* Koch, and *C. lucidulus* Koch.

So far as I can learn no infections were made with these parasites.

15. Drepanidotænia setigera (Frölich, 1789) Railliet, 1893.

(1789, *Tænia setigera* Frölich; 1800, *Alyselminthus setigerus* (Frölich, 1789) Zeder; 1803, *Halysis setigera* (Frölich, 1789) Zeder; 1819, "*Tænia sinuosa* Rud.," 1810, of Rud., pars.—vide Krabbe, 1869; 1848, "*T. setigera* Frölich," 1789, of Siebold; 1858, "*T. fasciata* Rud.," 1810, of Feuereisen; 1869, "*T. setigera* Frölich" of Krabbe.)

[Pl. XII, figs. 147–150; Pl. XIII, figs. 154–164.]

Diagnosis: Strobila 200^{mm} long by 1^{mm} to 3^{mm} broad. Head subglobular, 0.24^{mm} long by 0.28^{mm} to 0.33^{mm} broad; rostellum with simple crown of 10 hooks 35 μ to 43 μ (40 μ to 60 μ long, prong 20 μ long, roots 20 μ apart, after Feuereisen); ventral root short and plump, dorsal root longer. Suckers rather large, elliptical. Neck, 0.59^{mm} long by 1.16^{mm} broad. (Segments very short, 10 times as broad as long, Feuereisen.) Anterior segments very short, the following slightly longer, funnel shaped, with very prominent posterior angles; chain traversed by a dark median band. Pores unilateral, small, situated toward anterior angle of the segment, frequently with extruding penis. Genital organs begin with eight hundred and thirtieth segments; embryos begin with one thousand five hundredth segment. Calcareous bodies less numerous than in *Dr. fasciata*. *Male organs:* Male maturity is reached about the one thousand and thirtieth segment and is continued about 100 segments. Testicles three, 13 μ in diameter, posterior; an uncertain body (probably vesicula seminalis) lateral but near median line; vas deferens parallel and near anterior margin; cirrus pouch 0.35^{mm} long, more than half as broad as the younger segments, parallel to and near anterior margin, 39 μ (median portion) 19 μ (lateral portion) broad; broadest part is 160 μ to 190 μ long and contains a vesicula seminalis 0.1^{mm} to 0.15^{mm} long by 30 μ broad; penis covered with minute spines. *Female organs:* Very imperfectly understood. A body appears on aporose side of median line, develops and divides into two pyriform bodies, which remain connected (=ovary?); from their point of juncture a canal runs toward the genital pore, and shows two swellings, a median (? receptaculum seminis) and a lateral (? receptaculum seminis); an oval body (=? ovary) appears in the extreme aporose side of the segment, and from this extends another

body (uterus) toward the median line, increasing in size as the (?) ovaries decrease. Oncospheres 19 μ, hooks 7.9 μ.

Development: *Cercocystis Dr. setigeræ* in *Cyclops brevicaudatus* Claus, found by Schneil.

Hosts: Tame goose (*Anser anser dom.*); white-fronted goose (*A. albifrons*); bean goose (*A. fabalis*); barnacle goose (*Branta leucopsis*); tame swan (*Olor cygnus dom.*) cited by von Linstow, but Railliet believes this erroneous; whooping swan (*Olor cygnus*).

Geographical distribution: Germany, France, Denmark, Sweden, and Ireland. Lucet found it producing a serious epidemic among the young geese in Loiret (Railliet, 1893, p. 301).

The name *Tænia setigera* was proposed by Frölich (1789, pp. 106–111) for a worm 3 feet long and 3 lines broad, with unilateral genital pores, which he found in pastured geese. He states that the rostellum is unarmed; the form is, like many earlier species, not well described, and the figures are poor, so that it is not possible to tell with absolute certainty what species Frölich examined. Bellingham (1844, p. 320) records it for Ireland. Von Siebold (1848, p. 131) states that in this species he found 10 hooks on the rostellum. There is no way of proving that Siebold's worm was Frölich's *setigera;* at the same time, as there is no way of disproving it, we may as well accept von Siebold's statement regarding the hooks; the species *setigera* accordingly would rest upon this character. Feuereisen (1868, pp. 190–200) described the anatomy of a goose tapeworm, determined as *T. fasciata* Rud., which possessed 10 hooks and is probably identical with von Siebold's *T. setigera* Frölich. In 1865 and 1868 Krabbe (1869, pp. 289–290) examined 400 geese and found *T. lanceolata* present in 77 of them, and another tapeworm 9 times which possessed 10 hooks on the rostellum: this latter worm Krabbe determined as *T. setigera.* Krabbe also examined specimens from Rudolphi's collection (see Rud., 1819, p. 700) collected by Brosche in Dresden, and determined by Rudolphi as *T. sinuosa;* these worms were "undoubtedly identical with" *T. setigera.* Lönnberg (1889, p. 8) records this species for *Anser segetum* (new host) in Kristineberg; he also includes the white-fronted goose (*Anser albifrons*) among the hosts, but does not state his authority. Railliet (1893, p. 301) placed *T. setigera* in his genus *Drepanidotænia.* Von Linstow (1892B, pp. 503–504) states that Dr. O. Schmeil found in *Cyclops brevicaudatus* a globular cysticercoid 0.133^{mm} in diameter, with a thin, long (2.14^{mm}) tail, 10 hooks 39 μ, on the rostellum, which von Linstow identifies as the young of *T. setigera.* No infections were made. The life history as given above is, therefore, theoretical though probable.

16. Tænia Krabbei Kowalewski, 1895 [nec Moniez, 1879]. [Sp. dub.]

(1894, *Tænia Krabbei* Kowalewski [nomen nudum].)

[Pl. XII, figs. 151–152.]

Krabbe (1860, p. 290) states that he once found in the intestine of a domesticated goose a tapeworm head with 10 hooks similar in form to those of *Drepanidotænia setigera* but much smaller, i. e., 24 μ long. He thought that perhaps it belonged to another form, but figured the hooks as "*T. setigera?;*" the hooks, as well as the head, bore a great resemblance to *Drepanidotænia tenuirostris.* He also found a few heads with 10 similar hooks in the domesticated duck; the hooks were 28 μ long. Kowalewski (1894, p. 5), in a paper which I am unable to read because of the language, mentioned this worm as a new species under the name *Tænia Krabbei.* In a second paper (1895, p. 359, Taf. VIII, fig. 27), he gives a short discussion of the worm, and figures 2 hooks. In the German resumé (1894, p. 279) of this paper he simply states: "A species from the goose which was already found by Krabbe, but not described, is proposed as a new species (*Tænia Krabbei*) and its external characters are discussed."

The status of this species can not be judged at present, but the slight variation in the form of the hooks is not, in my opinion, sufficient to establish the form. As Kowalewski has unfortunately written in a language which is not understood by

many authors, it is difficult to judge his work, and as it is now necessary for an investigating helminthologist to learn no less than ten languages in order to keep up with his branch, it is to be hoped that Kowalewski will in the future give full translations of his scientific articles in German, French, English, Italian, or some other language better known than his own.

Whatever may prove to be the status of this species, the name *T. Krabbei* can not be retained for it, as this name has always been used by Moniez for another form.

17. Drepanidotænia tenuirostris (Rudolphi, 1819) Railliet, 1893.

(1819, *Tænia tenuirostris* Rudolphi.)

[Pl. XIV, figs. 165–172.]

Diagnosis: 100^{mm} to 125^{mm} long, 1^{mm} to 3^{mm} broad. Head subglobular; rostellum delicate, subclaviform, armed with a single crown of 10 hooks 20 μ to 23 μ long; suckers round. Neck rather long. Anterior segments straight and short, the following longer, with sharp prominent posterior angles, like the teeth of a saw. Genital pores unilateral. Egg cylindrical, 85 μ long. Hooks of oncosphere 7 μ.

Development: Cercocystis Dr. tenuirostris in *Gammarus pulex*, found by Hamann and von Linstow; in *Cyclops agilis* and *C. pulchellus* found by Mrázek.

Hosts: Tame goose (*Anser anser dom.*); European scaup duck (*Aythya marila*); tufted duck (*Aythya cristata*); goosander (*Merganser merganser*); red-breasted merganser (*M. serrator*); smew or nun (*Mergus albellus*); Greenland eider (*Somateria mollissima*); velvet scoter (*Oidemia fusca*); kittiwake (*Rissa tridactyla*).

Geographical distribution: Denmark, France, Germany, and Bohemia. No epidemics recorded.

Krabbe (1869, pp. 291–292) examined Rudolphi's types and found hooks upon the rostellum, although they had escaped Rudolphi's attention. The original specimens were collected by Bremser from *Merganser merganser;* von Siebold also found this species in the same host in Bavaria and Krabbe found the same worm in *Aythya marila.* It is also reported from other wild birds. Bellingham (1844, p. 320) gives *Aythya cristata* as a host, but does not state his authority.

Hamann (1889, pp. 7–9, figs. *a–c*) found a cysticercoid in *Gammarus pulex* which he looks upon as the larval stage of this worm, and he assumes that as the domestic duck is the only bird (i. e., so far as Hamann knows) which visits the water in which this larval stage was found, this tapeworm is also found in domesticated ducks. An argument like this has value in science only in order to place us on our guard for the parasite, but it would be going altogether too far to accept this worm as a parasite of domesticated ducks until it is found in that host. Hamann made no infections with his larval form, and accordingly the demonstration that this cysticercoid represents the larval stage of *Dr. tenuirostris* is still lacking. Hamann describes the larva as lying in a cyst fastened to the intestine of the crustacean, and possessing a yellowish tail and grayish-white body; diameter 0.2^{mm}, hooks 10 in number, 23 μ long; calcareous bodies oval 6 μ, oncospheric hooks 9 μ. Von Linstow (1892A, pp. 338–339) observed the same larva in the same host, and Mrázek (1891, pp. 101–103, 126–129) describes it from *Cyclops agilis* and *Cycl. pulchellus* in Bohemia. His specimens were very small 0.10^{mm} to 0.11^{mm}; 10 hooks 21 μ to 23 μ; tail long; oncospheric hooks 8 μ.

B. Genital pores irregularly alternate.

18. Drepanidotænia infundibuliformis (Goeze, 1782) Railliet, 1893.

(1772, *Globus stercoreus* Scopoli—vide Parona, 1894; 1779, *Tænia infundibulum* Bloch—vide Goeze, 1782; 1781, *T. avium* Pallas—vide Goeze, 1782; 1782, *T. articulis convideis* Bloch—vide Rud., 1810; 1782, *T. infundibuliformis* Goeze; 1786, *T. cuneata* Batsch [nec Linstow, 1872]—vide Rud., 1810; 1788, *T. conoidea* Schrank—vide Rud., 1810; 1794, *T. serrata* Rosa [nec Goeze, 1782]—vide Parona, 1894; 1800, *Alyselminthus infundibuliformis* (Goeze) Zeder; 1803, *Halysis infundibuliformis* (Goeze) Zeder.

[Pl. XIV, figs. 173–186; Pl. XV, figs. 187–193.]

Diagnosis: 20^{mm} to 130^{mm}, rarely 230^{mm} long. Head globular, rather depressed; rostellum elongate, cylindrical, or hemispherical, swollen at summit, armed with a single row of 16–20 hooks 20 μ to 27 μ long, with long dorsal and short ventral root; suckers rather small. Neck very short. Anterior segments very short, the following funnel shaped, the anterior border being much narrower than the posterior border; posterior segments almost as long as broad. Genital pores irregularly alternate. Penis thick, covered with few spines. Hooks of embryo 12 μ to 17 μ. (See also diagnosis given below, p. 44.)

Development: According to Grassi & Rovelli the cysticercoid develops in the ordinary house fly.

Hosts: Chickens (*Gallus domesticus*); migratory quail (*Coturnix coturnix*); ? pheasants (*Phasianus colchicus*); mallard (*Anas boschas*); tame duck (*Anas boschas dom.*); ?crowned pigeon (*Goura* sp.); ? domesticated pigeon (*Columba livia dom.*); sparrow (*Fringilla domestica*).

Geographical distribution: France, Italy, Ireland, Zealand (Denmark) (Krabbe), Pomerania (Creplin), and Saxony (Küchenmeister). No epidemics.

The earlier descriptions of *Dr. infundibuliformis* are exceedingly unsatisfactory, and in many cases it is impossible to recognize what species an author had before him when he determined it as *infundibuliformis.*

Krabbe (1869, pp. 339–341) examined Rudolphi's (1810) specimens and determined the forms from chickens as "undoubtedly identical" with specimens which he collected in Zealand, and with specimens from Creplin's and Küchenmeister's collections. Rudolphi's (1810, p. 124) specimens from *Otis tarda*, however, Krabbe determined as different from the specimens from chickens.

This seems to be the earliest exact reference to this species, which, therefore, rests upon Krabbe's (1869) study of the material which Rudolphi (1810, pp. 123–126) determined as Goeze's (1782, pp. 386–390) *Tænia infundibuliformis.* Unless original specimens of authors before Rudolphi can be studied again, and unless it can be shown by this means that Rudolphi's (1810) specimens were not really identical with Goeze's *infundibuliformis*, this specific name may at present be applied to the parasites as determined by Krabbe. It is useless to revert to the names prior to *infundibuliformis*, 1782, unless the originals upon which those names were based can be restudied. Bellingham (1844, p. 319) records this species for *Anas boschas, A. boschas dom.*, and *Fringilla domestica.* The form which Dujardin (1845, p. 586) determined as *infundibuliformis* is referred to *Davainea cesticillus.* Krabbe found this worm (*Dr. inf.*) in 26 out of 200 chickens in the region of Copenhagen. Mégnin (1881A, pp. 33–35) states that he found *T. infundibuliformis* in large numbers in the epidemics of syngamosis among pheasants, but it is evident that the form he referred to was his *T. agama.* Bremser also records it from pheasants, but his observation should be confirmed. Mégnin records it for pigeons and in *Goura*, but these observations also need confirmation, for Mégnin remarks that the specimen from *Goura* had three rows of hooks upon the suckers, (? *Davainea cesticillus*, q. v. p. 48). Piana (1882, p. 392) found this parasite the most common tapeworm of chickens. Grassi & Rovelli (1889, p. 404; 1892, pp. 33–34, 89) state that they found the larval stage in the house fly (*Musca domestica*), but they did not prove their point experimentally. Crety (1890, pp. 5–8) records *Coturnix communis* as a new host, and remarks upon the anatomy of the parasite. Unfortunately the figures are unsatisfactory, and the description is, therefore, not of such value as it otherwise would be; from his description the following characters are taken:

Diagnosis: (*T. infundibuliformis*) Strobila to 100^{mm}. Head very small, spheroidal, 0.387^{mm} broad; rostellum armed with 20 hooks upon its cupola-like extremity; length

of rostellum 0.137mm, breadth 62 μ to 75 μ; hooks 23 μ long; suckers 0.215mm by 0.156mm. Neck very short, 0.313mm in length; middle segments 0.48mm long, posterior segments 0.901mm long. Genital pores ———. *Male genitalia:* Testicles 16 to 20 in number, 29 μ to 44 μ in diameter, situated in median field; vas deferens begins about the middle of the segment, first portion slightly sinuous, lateral portion very tortuous; cirrus pouch globose, 71 μ in diameter; cirrus armed with numerous small spines. *Female genitalia:* Receptaculum seminis 106 μ by 39 μ, situated near the ovary; ovary globose, near anterior margin, occasionally irregularly divided into two halves; oviduct runs from ovary, in median line, distally; vitellogene gland in about the middle of the proglottid is generally globose, occasionally irregularly divided into two portions, vitello-duct runs cephalad from its median portion; shell gland very small, between ovary and vitellogene gland; uterus forms very quickly, in the mature proglottid it occupies the entire median field and is composed of a large cavity imperfectly divided into numerous small cells (=egg capsules?). Ova 55 μ by 46 μ, with 3 shells; oncosphere 33 μ, hooks 17 μ. (Krabbe: hooks 12 μ to 17 μ.)

Pasquale (1890, p. 909) records the worm for chickens in Massowah. Ralliet (1893, p. 302) well remarks that the generic position of this species is doubtful. (See addendum, p. 61.)

I refrain from discussing this form further, except to remark that practically nothing is definitely known about the species. Crety's description is the only one which can be given the dignity of a diagnosis, and yet that was not based upon originals. The earlier descriptions, which take no account of the internal anatomy of the segments, are almost useless so far as zoological descriptions are concerned. Were it not for the fact that the original host (chickens) is known, I have the most serious doubt whether it would ever be possible to recognize this form; and whether even the numerous specimens recorded from chickens as *T. infundibuliformis* are to be considered as such is, in my opinion, an open question. I have specimens of worms from pigeons (*Columba domestica*) and from turkeys (*Meleagris gallopavo mexicana*), which I should like to determine as *Dr. infundibuliformis*, but it seems to me that this specific name, like *Tænia expansa* of older authors, is only a Latinized form of expressing one's doubts or ignorance as to what species is in the hands of a given worker, while as for the supposed life history, with the fly as intermediate host, although I am not willing to deny the correctness of the hypothesis, I do insist that it is only an hypothesis, with little back of it, and that it is now time to call a halt on such speculative work and to distinguish between what is shown experimentally to be fact, and what might possibly be shown to be fact. (See also *Tænia nigropunctata.*)

B. Suckers armed: genera *Davainea, Echinocotyle,* and *Ophryocotyle.*

Genus **DAVAINEA** R. Blanchard & Railliet, 1891.

(? 1893, *Chapmania* Monticelli.)

Diagnosis: Worms of small or medium size. Head rounded, surmounted by a rostellum or hollowed by a depression, but armed in either case with a double row of numerous small hooks possessing a special form (prong and dorsal root short,

ventral root very long, giving them the form of a hammer). Suckers rounded, bordered with several rows of small hooks which are instable or persistent. Genital pores generally unilateral but occasionally irregularly alternate; in the former case (unilateral pores), the ova are generally arranged in groups, in egg capsules; ovary in some species develops into the uterus; eggs also isolated, scattered through the parenchyma; embryos without pyriform body.

Type species: As the type species has evidently never been proposed, I propose *D. proglottina* (Davaine, 1860) R. Blanchard, 1891, as type.

Development: As yet little known; the larvæ of some species, however, have been found in certain arthropods and mollusks.

Habitat: Intestine of birds and mammals.

Blanchard (1891B, pp. 428–440) recognizes fourteen species as belonging to this genus, and thinks that *T. cantaniana* and *T. clavulus* may also be placed here. Some of the forms Blanchard includes here are well established, others rest upon weak characters.

Monticelli (1893, pp. 16–17) has recently proposed a new genus *Chapmania* which seems to be very closely related to, if not identical with *Davainea.* His diagnosis reads as follows:

Head rounded, small, with a protractile anterior sucker armed on its anterior margin with a crown of very minute hooklets. Suckers rather large, unarmed. Proglottids campanulate. Genital pores unilateral. Testicle single. Ovary bilobed, dendritic.

Monticelli took Zschokke's (1888, pp. 2–6, 41–46) *Tænia argentina* as basis for his genus, and considered this species identical with Chapman's *Tænia tauricollis.* In this latter point Monticelli is probably in error, while as for the genus, it certainly rests upon too weak characters to be recognized at present. The "anterior sucker" is, of course, the invaginated rostellum and sac; the only valuable character remaining is the single testicle. The bilobed dendritic ovary, the form of the segments, etc., must all be rejected as generic characters.

The exact status of the genus and the ? one or ? two species (*tauricollis* and *argentina*) must be left undecided for the present.

1. Genital pores alternate 2
   Genital pores generally unilateral, occasionally alternate; rostellum with about 200 hooks 6 μ long ..... *D. tetragona*, p. 49
   Genital pores unilateral 4

2. Segments not over 5 in number; strobila 1.5^{mm} long or less; rostellum with about 80 hooks 7 μ long; found in chickens ..... *D. proglottina*, p. 47
   Segments numerous, and strobila much longer than 1.5^{mm} 3

3. Rostellum with about 100 hooks 8 μ long; found in chickens and (?) pigeons ..... *D. echinobothrida*, p. 49
   Rostellum with 208 hooks 7 μ to 8 μ long; found in chickens ..... *D. cesticillus*, p. 48
   Rostellum with about 800 hooks 11 μ long; found in quails ..... *D. circumvallata*, p. 47

4. Rostellum with 150 hooks 12.8 μ long; found in pheasants ..... *D. Friedbergeri*, p. 52
   Rostellum with ca. 60 hooks 11 μ long; found in pigeons and (?) ducks ..... *D. crassula*, p. 53

a. Genital pores irregularly alternate.

19. Davainea proglottina (Davaine, 1860) R. Blanchard, 1891.

(1860, *Tænia proglottina* Davaine; 1881, "*T. proglottidina* Dav." of Piana.)

[Pl. XV, figs. 194–198; Pl. XVI, figs. 199–202.]

Diagnosis: 0.5mm to 1.55mm long by 0.18mm to 0.50mm broad. Head club shape to quadrangular, 140 μ to 250 μ long by 135 μ to 200 μ broad, rather rounded in front and slightly constricted in back to form neck (108 μ broad); apex armed with retractile hemispherical rostellum 55 μ in its antero-posterior diameter and 60 μ to 85 μ in its lateral diameter; base of rostellum armed with about 80–95 hooklets measuring 6.5 μ to 7.5 μ. Suckers circular, small (25 μ to 35 μ), armed with a single row of hooklets (6 μ), with rather large, bilobed base. Strobila composed of 2–5 segments, first segment only about 56 μ long, the following segments increasing in length and width. Genital pores irregularly alternate, situated at the anterior angle. The second segment possesses well-developed male organs and the anlagen of the female organs. In the third segment the testicles are atrophied, the female organs (median posterior vitellarium, two ovaries, recept. sem., vagina) well developed, but no uterus present. In the fourth segment all the genital glands are atrophied, and the segment is filled with numerous isolated eggs (not in egg capsules); ova 35 μ to 40 μ; hooks of oncosphere 10 μ to 11 μ. The segments have a great tendency to separate more or less completely; the last segment, after separating, remains in the intestine and grows to 2mm long by 1.25mm broad (larger than the entire worm).

Development: Larval stage is found in slugs (*Limax cinereus, L. agrestis,* and *L. variegatus,* and develops from the oncosphere in less than twenty days; fed to chickens, the cysticercoid becomes adult with 4 segments at the end of eight days.

Host: Chickens (*Gallus domesticus*).

Geographical distribution: France (Rennes by Dujardin), in le Nord by Davaine, in Loiret by Lucet, in Indre-et-Loire by R. Blanchard, and Italy by Grassi & Rovelli.

Epidemics: Lucet observed a serious epizootic enteritis in fowls produced by this parasite in Loiret (Railliet, 1893, p. 305).

The life history of this worm has been experimentally demonstrated and this is one of the few tapeworms of fowls which can be said to be comparatively well known from a scientific standpoint.

20. Davainea circumvallata (Krabbe, 1869) R. Blanchard, 1891.

(1819, *Tænia linea* Rud., pars; 1869, *T. circumvallata* Krabbe; 1890, *T. pluriuncinata* Crety.)

[Pl. XVI, figs, 203–211.]

Diagnosis: Strobila 40mm to 150mm long. Head pyriform 0.627mm to 0.8mm long by 0.598mm to 0.65mm broad. Rostellum armed with a double row of about 800 minute hooklets, of two different sizes, the larger and smaller alternating, the larger hooks 11 μ (Krabbe), 16 μ (Crety); smaller hooks 8 μ (Krabbe), 12 μ (Crety). In the earlier stages (see below *T. pluriuncinata*) the suckers are armed with 6–8 concentric rows of instable hooks which vary in size, but of similar form. Suckers small, 0.186mm to 0.196mm in diameter. Neck present, thin. Anterior segments 0.195mm broad by 0.40mm long (after Crety, 1890, p. 2, the figures should undoubtedly be reversed); middle segments 2mm to 3mm broad by 1mm long; posterior segments 1.5mm long by 2.5mm broad. Genital pores irregularly alternate in about the middle of the lateral margin. *Male genitalia:* In posterior portion of segment; testicles 15–20 in number, 45 μ in diameter, distributed regularly in median field; the common vas

deferens takes origin in about the middle of the segment, medium portion more or less simple, lateral portion convoluted; upon entering the cirrus pouch it swells into a vesicula seminalis, 53 μ long by 39 μ broad, distinct only in the younger segments; cirrus covered with extremely minute spines, visible only with an immersion lense. *Female genitalia:* In anterior portion of segment. Ovary median near anterior margin, at first transverse, in the older segments it becomes globose and occasionally irregularly divided into two lateral halves, connected by a median portion which leads into the oviduct; in middle proglottids transverse diameter of ovary 0.186^{mm}; oviduct short, runs distally; vitellogene gland distal of ovary, in youngest segments appears as a globular sac next to ovary, in older segments further removed from it and much smaller than it, occasionally divided; vitelloduct runs from middle of vitellogene gland proximally; shell gland very small, situated between ovary and vitellogene gland; vagina swells into a receptaculum seminis 58 μ by 39 μ near the ovary; uterus forms rapidly, suppresses genital glands, eggs arranged 4–6 or more in egg capsules. Ova 28 μ by 24 μ; hooks of oncosphere 11 μ to 17 μ (Krabbe), 3 μ to 4 μ (Crety), oncosphere 11 μ.

Type specimen: Berlin museum.

Life history: Unknown.

Hosts: Migratory quail (*Coturnix coturnix*) by Rudolphi and Crety; (*C. dactylisonans*) by Ninni [Stossich].

Geographical distribution: Italy, by Rudolphi, Crety, and Ninni.

Blanchard (1891B, p. 434) looks upon Crety's *Tænia pluriuncinata* as synonymous with *D. circumvallata.* Crety's description of *T. pluriuncinata* is as follows:

Diagnosis: Strobila up to 105^{mm} long. Head very small 0.313^{mm} broad. Rostellum armed with a double row of alternately larger and smaller hooks, the larger 8 μ, the smaller 5 μ long, in form very similar to those of *T. circumvallata;* suckers very small, 98 μ in diameter, armed with 6–8 concentric rows of hooks, the latter varying in size, but of similar form. Neck 2.5^{mm} long, thin. Young segments 0.323^{mm} broad by 0.2^{mm} long; middle segments trapezoid, 3^{mm} broad; posterior segments 2^{mm} broad by 1^{mm} long. Genital pores irregularly alternate; genital apparatus (very insufficiently described); cirrus pouch pyriform, 127 μ by 20 μ; ova in egg capsules same as in *T. circumvallata;* diameter of ova 22 μ by 16 μ; oncosphere 9 μ.

Host: Migratory quail (*Coturnix coturnix.*)

Whether Blanchard is correct in his opinion can be determined only by a comparison of specimens, but in the meantime one is bound to admit that *T. pluripunctata* can hardly be admitted as a species upon its present diagnosis.

21. Davainea cesticillus (Molin, 1858) R. Blanchard, 1891.

(1845, "*Tænia infundibuliformis* Goeze," 1782, of Dujardin; 1858, *T. cesticillus* Molin; 1881, *T. infundibuliformis* pars of Mégnin.)

[Pl. XVII, figs. 212–216.]

Diagnosis: Length, 9^{mm} to 45^{mm} (according to Molin), 100^{mm} to 130^{mm} (according to others). Head globular, 0.5^{mm} to 0.55^{mm} broad; rostellum convex or hemispherical, not prominent, 0.28^{mm} to 0.32^{mm} broad, armed with about 208 hooks 7 μ to 8.8 μ long, arranged in two rows; these hooks have a very short dorsal and a long ventral root; suckers 10 μ to 11 μ, not prominent. Neck very short (Duj.) neck absent (Railliet). Anterior segments 3–5 times as broad as long, being broader than the head, but very short; the following segments increasing gradually in size and becoming nearly as long as broad, borders overlapping. Genital pores irregularly alternate. Eggs elliptical 75 μ to 85 μ; hooks of oncosphere 16 μ to 17 μ (Railliet) 18 μ to 23 μ (Dujardin). Development unknown.

Host: Chickens.

Geographical distribution: France (by Dujardin); Italy (by Molin, Grassi, Rovelli); Denmark (by Krabbe); Turkestan (by Fedtschenko); Abyssinia (by Pasquale). Epidemics: None recorded.

Dujardin (1845, pp. 586, 609, Pl. IX, fig. H, 1–2) erroneously determined this worm as *T. infundibuliformis;* Molin (1858, p. 139) described it as *T. cesticillus.* Krabbe (1869, pp. 342–343) found it in 16 out of 200 chickens in Denmark, and mentions a somewhat similar worm from Siebold's collection, taken in Egypt by Bilharz. Piana (1882) records *T. cesticillus* in Italy and Pasquale (1890) says it is the most common form at Massowah (Abyssinia), where he in one instance took about 300 from one chicken. Grassi & Rovelli (1892, p. 88) suspect that the intermediate host is a lepidopteron (butterfly) or a coleopteron (beetle), but this is wild speculation. Stossich (1890A, p. 39; 1890B, p. 53) records the same species in two different publications, once as being collected in Venice by Ninni, and a second time as being rather rare in chickens in Trieste. Blanchard (1891B, p. 434) looks upon part of Mégnin's *T. infundibuliformis* as belonging here; the worm in question has, according to Mégnin (1881A, pp. 27–44) 3 rows of hooks on the suckers.

For Neumann's (1888 and 1892) combination *T. cesticillus* var. *phasianorum* which he attributes to Mégnin (1887, p. 828), vide p. 53 (*Tænia infundibuliformis* var. *phasianorum* Mégnin, 1887, p. 825 ff., under *T. Friedbergeri*).

22. Davainea echinobothrida (Mégnin, 1881) R. Blanchard, 1891.

(1880, *Tænia infundibuliformis* of Mégnin (pars); 1880, *T. echinobothrida* Mégnin, nomen nudum; 1881, *T. echinobothrida* Mégnin.)

[Pl. XVII, figs. 217–218.]

Diagnosis: 50mm to 100mm long, 1mm to 4mm broad. Head small, cuboid, its summit presenting an infundibulum armed with about 100 hooks, 8 μ long, arranged in a double row. Suckers large, armed with 7 circular rows of hooks, the hooks of the middle row being the largest; with age these hooks fall and the suckers gradually become indistinct. Neck nil. Anterior segments very thin, 50 times broader than thick; following segments increasing gradually in size, the posterior border overlapping, so that the margin of the strobila appears serrate. Eggs spherical, 90 μ in diameter, arranged in groups of 6–7 in roundish egg capsules. Development unknown.

Hosts: Chickens (Mégnin), ? pigeons (Mégnin—possible another species of worm according to Railliet), and ? pheasants (see Blanchard).

Geographical distribution: France by Mégnin. Epidemics: Mégnin states that this did not produce any serious effects in its hosts.

The types of this species should be compared with *D. tetragona* and *T. bothrioplitis,* as the worms are very similar, if not identical. The character of the genital pores as a specific difference I can hardly admit for this form. (See the discussion under *D. tetragona.*) Mégnin states that the hooks of the middle rows of the suckers are the largest and this, if the observation is confirmed, would separate the species from *T. bothrioplitis.*

b. Genital pores unilateral, occasionally alternate.

23. Davainea tetragona (Molin, 1858) R. Blanchard, 1891.

(1858, *Tænia tetragona* Molin; 1881, *T. bothrioplites* Piana (nomen nudum); 1882, *T. bothrioplitis* Piana.)

[Pl. XVII, figs. 219–227; Pl. XVIII, figs. 228–235.]

Diagnosis: 12mm to 90mm long (Molin) or to 200mm (Piana) or to 250mm (Krabbe), by 1.6mm to 3mm broad. Head small, tetragonal; retractile rostellum armed with a double row of about 200 hooks, 6 μ long. Suckers circular, armed with seven or eight concentric rows of hooks of varying size. Neck very long. Anterior segments very short; the following subquadrangular, the posterior edges overlapping.

Genital pores unilateral or irregularly alternate, situated in or about the middle of the margin. Eggs arranged irregularly in groups of 5–20 in egg capsules.

Development: According to Piana, the larval stage (*Monocercus Davaineæ tetragonæ*) develops in snails (*Helix carthusianella* or *H. maculosa*).

Hosts: Chickens.

Geographical distribution: Italy (by Molin, Piana), Turkestan (by Fedtschenko), Abyssinia (Pasquale), America (Washington, D. C., by Moore).

Epidemics: Italy by Piana; Washington, D. C., by Moore.

I include *T. bothrioplitis* in the species *D. tetragona* and retain *D. echinobothrida* as a distinct species, chiefly in deference to the opinion of my friends R. Blanchard and Railliet. Personally I do not see why the species *D. tetragona* should be recognized, or why two of these forms should be united while the third is kept distinct, for the descriptions of all three forms are incomplete, and, as will be shown in the following historical review, any arrangement of the three worms can be looked upon at present only as provisional. The historical review is given in detail, as these three (or one?) species represent very important parasites.

Molin (1858, p. 139) first described as *Tænia tetragona* some tapeworms which he found in chickens in Padua in December, 1857, as follows:

Caput tetragonum, minimum, acetabulis quatuor angularibus, alveolo ad basim rostelli excavatum; rostellum inerme, brevissimum, obtuso-conicum, in alveolum retractile; collum breve; articuli supremi brevissimi; postremi subquadrati, imbricati; aperturæ genitales marginales, secundæ, in apice papillæ prominulæ. Longit. 0.012–0.090; lat. ad 0.002.

Habitaculum. Phasianus Gallus: in intestino tenui, Decembri, Patavii (Molin).

Like most of Molin's descriptions, this diagnosis gives us but little information concerning the parasite he had before him. It should be noticed, however, that he (probably erroneously) describes the rostellum as unarmed, the neck as short (a character of little or no value), the posterior segments subquadrate and imbricate, the genital pores as unilateral, the length of the worm as 12^{mm} to 90^{mm}, breadth as 2^{mm}. In other words, there is neither a single distinctive character nor a collection of characters given in this diagnosis. In his second paper (1860, pp. 254–255; Taf. VII, 5–8) Molin repeats this diagnosis, gives four figures of the worm which are almost useless, except fig. 7, in which the genital pores are figured in the middle of the lateral margin, and in which some irregularly-shaped masses are drawn, which evidently represent egg capsules. He also adds three observations to the effect that he collected 42 specimens from one chicken, of which number only 2 were mature, the others being very small. He describes a mosaic structure of the segment caused by egg capsules, each of which contains from 5 to 20 ova. Although the rostellum is unarmed, the form differs in organization from the other unarmed forms. These are all of the characters ever given by Molin to the species, and it must, indeed, be admitted that they are not sufficient to determine any worm with certainty. Molin's diagnosis, without the type specimens, is therefore useless.

As far as any original observations are concerned Molin's species *T. tetragona* then rested for a number of years. In 1880 Mégnin (1880, p. 119) mentioned *T. echinobothrida* as a nomen nudum. In 1881 two parasites of chickens, very similar to if not identical with *T. tetragona*, were described as new. Mégnin described and figured *T. echinobothrida* as a new species with the characters given in the diagnosis above (p. 49). A careful study of both figures and description shows that the most important characters at present to be considered are the hooks upon the rostellum, said to be about 100 in number, 8 μ long, the rows of hooks upon the suckers (6–7 rows), those of the middle row being the largest; genital pores irregularly alternate; eggs 90 μ in diameter, spherical, arranged in groups of 6–7 in roundish egg capsules.

In March of the same year[1] (1881) Piana (1882, pp. 387–391, 1 plate) presented a paper before the *Accademia delle Scienze di Bologna*, in which he described as a new species *T. bothrioplitis*, a cestode which he found causing serious damage to poultry, producing tubercles in the intestine. The chief zoological characters taken as a basis for the species are as follows:

Head 0.35^{mm} in diameter; retractile hemispherical rostellum armed with hooks (number not given, but evidently ca. 200, form shown in drawing); suckers with seven or eight concentric rows of hooks (form as per drawing), hooks not all of same size; neck very long, containing ovoid calcareous corpuscles; genital pores unilateral, situated somewhat below (distally) the middle of the lateral margin; cirrus short, pyriform; eggs in egg sacs.

Piana states that Rivolta and Delprato (in Ornitojatria, 1880, T. I., f. 5*a*—not accessible to me) picture the head of a cestode which produced similar nodules in the intestine of a chicken. Piana found 2 cysticercoids in Helix (whether in *H. carthusianella* or *H. maculosa* is not clear to me) which agree quite closely with the head of the parasite found in chickens; no experiments were made to demonstrate that this cysticercoid is the larval form of the worm in question, but their specific identity is assumed from their similarity. Piana was acquainted with Mégnin's paper, but separated his form from Mégnin's species chiefly on account of the form of the hooks on the suckers, the number of hooks on the rostellum, and the arrangement of the genital pores. Krabbe (1882, pp. 361–364, Tab. II, figs. 55–60) published as *Tænia tetragona* Molin, some cestodes which Fedschenko had found in chickens in Turkestan. He admits the total inadequacy of Molin's figures and descriptions, but determines his specimens as *T. tetragona* on account of the egg capsules. The characters given are as follows:

Length to 250^{mm}, breadth, 1.6^{mm}; posterior segments, 1.2^{mm} long by 1.6^{mm} broad. Head provided with a short and broad retractile rostellum, surrounded by about 200 hooks arranged in a double row; hooks measured 6 μ long from the apex of the prong to the end of the dorsal root; ventral root 11 μ long; suckers surrounded by several rows of similar instable hooks of different form from those of *T. australis*. Genital pores unilateral; cirrus smooth, 21 μ long by 8 μ thick. Eggs arranged in egg sacs, 10–12 ova in a group, 40 to ca. 90 groups in a segment.

Since Krabbe's paper, authors have as a rule accepted *T. tetragona* as a good species. Blanchard (1891B, pp. 433, 436) recognized *D. echinobothrida* as a distinct species; recognized *D. tetragona* (Molin) as valid, and made *T. bothrioplitis* a synonym of *D. tetragona*. Grassi & Rovelli (1892, p. 84) claim to have recognized both *T. tetragona* Molin and *T. bothrioplitis* Piana, and state that they have found both forms; *T. echinobothrida* Mégnin they did not find, but they think it is possibly identical with *T. bothrioplitis* Piana. Railliet (1893, pp. 306-307) has followed Blanchard (1891).

From the above it is questionable whether Molin's specific name *tetragona* can be retained, unless the originals can be found and redescribed, for the description given by Molin is unrecognizable without the types. It might possibly be retained upon the ground that it is impossible to show that *T. tetragona* of present authors is not identical with *T. tetragona* Molin. I refrain temporarily from suppressing the name, as I hope the types may be reexamined. Krabbe's description of *T. tetragona* can hardly be taken into consideration in this question, as there is nothing to show that his specimens are identical with Molin's forms, and as Krabbe himself admits the

[1]The date of publication of the volume for 1881 is given upon the cover as 1882, but a preliminary notice of this paper appeared in the Rendiconto in 1881. This preliminary notice, however, is altogether too incomplete to hold should the question of priority be raised between Mégnin's *T. echinobothrida* and Piana's *T. bothrioplites*. Further, as Piana cites Mégnin's article in the final paper, Mégnin's name must be given precedence, should these two forms prove identical. Piana's *T. bothrioplites* of 1881 is to all intents and purposes a nomen nudum, and his species *T. bothrioplitis* should be dated 1882.

uselessness of Molin's description and figures. The differences between the species described by these three authors (Mégnin, Piana, and Krabbe) are very slight and can for the most part be explained by contraction, insufficiency of material, and lack of details. The description of the hooks of the suckers of *T. echinobothrida* (as being so simple) should, I believe, be taken with reserve. The hooks are very small and are not easily studied. The fact that the genital pores are described as irregularly alternate by Mégnin and unilateral by Piana and Krabbe is not, in my opinion, a serious difference in this genus. This opinion, radical as it may appear, is based upon the following observations:

The worms which Dr. Moore found producing a nodular disease in chickens give rise to the same pathological conditions as the form described by Piana, and agree with Piana's species in regard to the armed rostellum, the form and size of the hooks, both on the rostellum and suckers, and in almost every other character mentioned by Piana. *The genital pores vary in different specimens.* In some specimens they are entirely unilateral; in other specimens all but one or two may be on the same side of the worm, in fact it is often necessary to mount the entire strobila before it is possible to find an alternating pore; in still other specimens the pores are extremely irregular. The specimens with irregularly alternate genital pores agree in all other respects, so far as I can see, with Piana's form. The only difference between these specimens and Mégnin's description appears to be (1) the number of hooks upon the rostellum (Mégnin estimates them at about 100, the American forms possess *ca.* 200–208); (2) the form of the hooks on the suckers (possibly due to misinterpretation as the form of hooks Mégnin describes is otherwise unknown in this group); and (3) the arrangement of the hooks on the suckers (in Mégnin's form the largest hooks are in the center row, in the American form the largest hooks are those of the external row). This latter point of difference should not be given too much weight, as Mégnin evidently made no microtome sections, and this point could hardly be established definitely otherwise.

In short, I incline to the belief that *tetragona*, *echinobothrida*, and *bothrioplitis* all represent one and the same species.

c. Genital pores unilateral.

24. Davainea Friedbergeri (von Linstow, 1878) R. Blanchard, 1891.

(1878, *Tænia Friedbergeri* von Linstow [May 16]; ? 1878, *Tænia agama* Mégnin [August]; ? 1878, *T. infundibuliformis* var. *phasianorum* Mégnin [September]; 1888, *T. cesticillus* var. *phasianorum* Neumann.)

[Pl. XVIII, figs. 236–242.]

Diagnosis: Strobila up to 200^{mm} and more long by 2^{mm} to 3^{mm} wide. Head pyriform, 0.386^{mm} broad by 0.30^{mm} long; rostellum armed with a double row of hooks, 75 in each row, 12 μ long; suckers elliptical, armed with 4–5 rows of hooks, of which those on the middle row are smallest. Neck thin, 2^{mm} to 3^{mm} long. Anterior segments very short, the following gradually increase in length, the distal borders projecting so as to give a serrate appearance to the worm; in the posterior sixth the segments become moniliform, the last segments almost globular, frequently orange in color. Genital pores unilateral, in middle of the margin. Ova 34 μ to 38 μ, oncospheric hooks 6.5 μ.

Development: Unknown; Friedberger and Mégnin think that ants (*"Formica rufa?"*) form the intermediate host, but experiments (Friedberger) were negative.

Hosts: Pheasants (*Phasianus colchicus*).

Geographical distribution: Germany and France.

Epidemics: Friedberger (1877, pp. 99–112) gives quite an extensive account of an outbreak of disease among pheasants which he attributed to the presence of the large number of tapeworms. A remarkable difference in the development of the young pheasants was noticed.

Many of them became sick. The appetite remained good for the most part, but the animals grew dull and their feathers became ruffled. Suddenly the animals would wake up, run around, and take food; then they would quiet down again, close their eyes, and finally die.

Several post-mortems were made, and in all cases numerous tapeworms were found in the intestine. A purulent, desquamative, intestinal catarrh and general anæmic condition were constant.

In August, 1878, Mégnin (1878A, p. 825) described as a new species (*T. agama*), afterwards (September, 1878B, p. 927) proposing to make it a variety (*T. infundibuliformis* var. *phasianorum*), a tapeworm which he found creating considerable trouble in the pheasantries near Paris and Fontainebleau. Hé gave the following characters:

Not over 60^{mm} long; head small, with about 100 hooks; neck variable, long and filiform or short. Head not over $\frac{1}{4}$^{mm} broad; body 1^{mm} to 3^{mm} broad. Ovary fills the entire posterior half of the body without being localized in each segment; segments detach themselves as round discs, rather thick, and 1.7^{mm} to 2^{mm} in diameter, filled with eggs, collected in egg-sacs, about 7 eggs being present in each sac and about 80–100 sacs in each segment. Mégnin suggests that ants form the intermediate host.

The parasites injured their hosts by stopping up the bowels, but good results in treatment resulted from administering powdered Kamala mixed with the food. In the second note Mégnin states that the pores are unilateral.

Neumann (1888, p. 433; 1892A, p. 471; 1892B, p. 485) erroneously attributes the combination *Tænia cesticillus* var. *phasianorum* to Mégnin (1887, p. 828); (this reference given by Neumann should undoubtedly read 1878, p. 928, as there were only 823 pages in the Recueil of 1887, and Mégnin apparently did not publish upon this species in 1887, i. e., so far as I have been able to trace). Railliet (1893, pp. 308–309) thinks it probable that Mégnin's species is identical with the worm described by Friedberger (1877) and named by von Linstow (1878).

25. Davainea crassula (Rudolphi, 1819) Railliet, 1893.

(1819, "*T. sphenocephala* Rud.," 1810 of Rudolphi; 1819, *T. crassula* Rud.,
(?1789, *Tænia serpentiformis i. T. turturis* Gmelin; ?1800, *Alyselminthus Columbæ* Zeder;
?1803, *Halysis Columbæ* (Zeder, 1800) Zeder; ?1810, *Tænia sphenocephala* Rud.; ?1891, *Davainea Columbæ* (Zeder, 1800) R. Bl.)

[Pl. XVIII, figs. 243–246.]

Diagnosis: 200^{mm} to 400^{mm} long by 4^{mm} broad. Head oval, rostellum obtuse, armed with about 60 hooks 10 μ to 11 μ long. Suckers rounded, armed with spines. Neck rather long. Anterior segments very short, the following segments a little longer and very wide, the posterior segments infundibuliform. Genital pores unilateral. Eggs united in groups of 10–12 in a capsule. Development unknown.

Hosts: Domestic pigeon (*Columba livia domestica*); European rock pigeon (*Columba livia*); turtle dove (*Turtur turtur*); rock partridge (*Caccabis saxitilis*); ? tame duck (*Anas boschas dom.*); parroquet (*Psittacus erithacus*) [perhaps *D. leptosoma*?]. Epidemics: None recorded.

Little more is known of this worm than the actual fact that the parasites described under the synonymy above are found in pigeons.

Zeder (1800, pp. 281–282) found a worm in the turtle dove which he named *Alyselminthus columbæ*, changing the name three years later to *Halysis columbæ*. This worm Rudolphi (1810, pp. 94–95) renamed *Tænia sphenocephala*, so there is evidently no doubt that these three terms are synonymous. Rudolphi includes in his literature a worm which Goeze (1782, p. 394) mentioned in a footnote as having been found in the turtle dove and which Gmelin (1790, p. 3070) quoted from Goeze as *Tænia turturis* under *T. serpentiformis*. It is entirely an assumption that Goeze's form is identical with Zeder's worm, although Gmelin's name refers to Goeze's species. Rudolphi (1819, pp. 154, 506–508) described as *T. sphenocephala*, evidently considering them identical with his *sphenocephala* of 1810, some worms obtained by Bremser; these were preserved in the Berlin Museum, were restudied by Krabbe and pronounced identical with Rudolphi's supposed new species (1819, pp. 702–704) *Tænia crassula*, types of which Krabbe also examined.

T. sphenocephala Rud., 1819 and *crassula* Rud., 1819, are evidently the earliest specific names to which we can refer with certainty, although the earlier names may be looked upon as probable but unidentifiable synonyms. According to page-priority *T. sphenocephala* should stand, but as that is an uncertain earlier synonym, and as Railliet has already used *crassula*, I retain the latter name for the present.

There are certain other species which must be considered in connection with this genus, but most of which are but little known at present. The following characters are taken from Krabbe (1869) and Blanchard (1891, pp. 434–438):

A. Avian parasites:

Davainea struthionis (Parona, 1885)—(Syn. 1810, *Tænia struthio cameli* Rudolphi, nomen nudum; 1819, *T. struthionis* Rudolphi, nomen nudum; 1885, *T. struthionis* Parona; 1893, *T.* (*Davainea*) *struthionis* von Linstow.) Parona's description of this parasite from ostriches is not accessible to me.

Davainea insignis (Steudener, 1877) R. Bl., 1891 (Syn. 1877, *Tænia insignis* Steudener). 100^{mm} to 130^{mm} long; rostellum armed with double crown of minute hooks; suckers also armed with gyriniform hooks, smaller than those of the rostellum, points directed inward; host: *Carpophaga oceanica*. (Original not at my disposal, I quote from R. Blanchard, 1891, pp. 434–435.)

Davainea australis (Krabbe, 1869) R. Bl., 1891 (Syn. 1869, *Tænia australis* Krabbe). Strobila 400^{mm} long, 1.2^{mm} broad; rostellum with a double row of 340–360 hooks 12 μ to 14 μ long; suckers with hooks, 5 μ to 11 μ long; genital pores unilateral; host: *Dromaius Novae-Hollandiæ*.

Davainea urogalli (Modeer, 1790) R. Bl., 1891. (Syn. after Krabbe 1869, p. 344: 1846, *Tænia tumens* Mehlis; 1850, *T. microps*). Strobila 300^{mm} long; rostellum with double crown of ca. 100 hooks 10–11 μ long; genital pores unilateral; hosts: *Tetrao urogallus; Tetrao tetrix; Cacabis saxatilis; Centrocercus urophasianus; Tetraogallus himalayanus*.

Davainea frontina (Dujardin, 1845) R. Bl., 1891. (Syn. after Krabbe, 1869: 1810, *Tænia crateriformis* Rudolphi, pars; 1845, *T. frontina* Dujardin.) Strobila 100^{mm} long by 1^{mm} broad; head 380 μ broad, rostellum 126 μ surrounded by a double crown of about 300 hooks 8 μ long; suckers 140 μ in diameter, armed with a large number of small hooks; genital pores unilateral; hosts: *Oriolus galbula, Picus viridis, ? P. major*.

Davainea circumcincta (Krabbe, 1869) R. Bl., 1891. (1869, *Tænia circumcincta* Krabbe). Strobila 120^{mm} long by 2^{mm} broad; rostellum armed with a double crown of about 300 hooks 11 μ to 12 μ long; suckers armed; genital pores ?; eggs in egg sacs; host: *Ardea garzetta*.

Davainea leptosoma (Diesing, 1850) R. Bl., 1891. (1850, *Tænia leptosoma* Diesing.) Strobila 160^{mm} long by 2^{mm} broad; rostellum with a double (?) crown of hooks 11 μ to 13 μ long; hooks on suckers?; genital pores unilateral; host: *Psittacus erithacus*.)

B. Mammalian parasites.

Davainea madagascariensis (Davaine, 1870) R. Bl., 1891. (1869, *Taenia madagascariensis* (Davaine), found in man.

Davainea Salmoni Stiles, 1895, found in *Lepus sylvaticus* and *Lepus melanotis*.

Davainea retractilis Stiles, 1895, found in *Lepus arizonæ*.

Davainea contorta Zschokke, 1895, found in *Manis pentadactyla*.

Genus **ECHINOCOTYLE** R. Blanchard, 1891.

Diagnosis: Body short and thin. Head elliptical or subspherical, provided with a long rostellum capable of being completely retracted, and armed with a single row of 10 hooks; dorsal root much longer than feeble ventral root. Suckers armed with three series of hooks, whose prongs point posteriorly; one series situated in the longitudinal axis of the sucker, one series on the borders of each side. Type species, *E. Rosseteri* R. Bl., 1891.

Development: Cysticercoid (Cercocystis) in the body cavity of Ostracodes.

Hosts: Domestic ducks (*Anas boschas dom.*); Bengal ducks.

26. Echinocotyle Rosseteri, R. Blanchard, 1891.

(1891, "*Tænia lanceolata* Goeze" of Rosseter.)

[Pl. XIX, figs. 247–251.]

Diagnosis: Strobila (young specimens) 1.5^{mm} long with 26 segments present; breadth, 0.18^{mm}. Head subspherical, 85 μ to 155 μ long by 75 μ to 105 μ broad; rostellum long, with single crown of 10 hooks on extremity, hooks measure 31 μ to 38 μ long; suckers oblong, 67 μ to 90 μ by 27 μ to 32 μ; muscular wall much reduced, concavity nearly effaced and visible only on account of the hooks; 100–130 hooks on each sucker with base 7 μ to 8 μ, prong 3 μ to 4 μ. Neck 90 μ to 140 μ by 45 μ to 70 μ. One specimen with 20 segments, last segment 153 μ long by 195 μ broad. Genital pores near anterior corner of segment; cirrus pouch large, extending over halfway across the segment.

Type specimens: Collection Rosseter; Collection Stiles.

Life history: Cysticercoid in *Cypris cinerea* Brady.

Hosts: Adults in tame duck (*Anas boschas dom.*), experimentally by Rosseter; Bengal duck (*Anas* sp?) by Rosseter.

Geographical distribution: Canterbury (Kent), England, by Rosseter.

Rosseter (1891A., p. 438) presented a communication to the Royal Microscopical Society stating that he had infected ducks with a cysticercus and thus raised *Tænia lanceolata*. There were from 180–200 minute hooks on the head. A fuller account is given in his second paper, in which Rosseter (1891B., pp. 224–228) states that he examined the *Cypridæ* of a pond near Canterbury for cysticercoids, and noticed that *Cypris cinerea* Brady contained two species of parasites. One was the larval form of *Tænia coronula* (=*Dicranotænia coronula*); a less common form occurred in about 2 per cent of those examined.

The latter form is oval, invaginated anteriorly and provided with a long caudal appendage; cyst is not fenestrated. While developing, its substance submits to active contractions, but when fully developed to a point where it can be transmitted to vertebrates it remains quiescent; rostellum invaginated, bearing a crown of 10 hooks 32 μ long, of which three-fifths are occupied by the dorsal root; ventral root rather truncate; prong short and slightly curved. Suckers oval, armed with about 132 hooklets, arranged symmetrically around the suckers; the hooks are very delicate, about 5 μ long.

A large number of crustaceans were fed to a duck daily from February 19 to March 21. Upon killing the duck a considerable number of tapeworms, which showed the same characters as the cysticercoid, were found in the upper portion of the small

intestine. The largest was 1.27mm long; the greater number of specimens possessed 17 segments. Male organs were well developed, but the female organs were not visible. Rosseter believed that the adult parasite which he has thus developed was *Tænia lanceolata* Goeze.

Blanchard (1881B, pp. 420–428, figs. 1–2) examined some of Rosseter's material and recognized that this form was not identical with *T. lanceolata*. He compared it with all the other species recorded for ducks, and with other avian tapeworms possessing 10 hooks on the head and unilateral genital pores, and concluded that Rosseter's cestode represented the type (*E. Rosseteri* R. Bl.) of a new genus (*Echinocotyle* R. Bl.). He added that Rosseter had recently informed him that he had sometime previous to the discovery of the cysticercoid placed some ducks imported from Calcutta on the pond in which he had discovered the parasites; upon making an autopsy on one of these ducks Rosseter found it infested with *Echinocotyle*. Blanchard concluded from this that the Bengal ducks imported the parasites with them and infected the pond in question. Blanchard discusses the adult worm, and from this description the specific diagnosis given above is written. Rosseter (1892, pp. 361–366, Pls. XXII–XXIII) again discusses this species and figures it.

Regarding the supposed introduction of this parasite into England by ducks from Calcutta, the idea advanced by Blanchard seems very plausible. At the same time, however, Blanchard states (p. 424) that neither he nor Rosseter have been able to examine any adult specimens. Now, had the Bengal ducks brought the parasites with them, would not the duck examined by Rosseter have been infested, in all probability, with the adult form, although they unquestionably could also have become infected with a new generation from the crustaceans? I hardly see why the fact that two Bengal ducks were placed upon this pond a short time before Rosseter discovered the parasites in the crustaceans bears anything more than a possible (but not necessary or probable) connection with the presence of this species in England; the parasite has not yet been recorded from Bengal.

Genus **OPHRYOCOTYLE** Friis, 1869.

[Pl. XIX, figs. 252–255.]

Diagnosis: Head enlarged anteriorly, without rostellum, but with several infundibula whose borders are armed with a very large number of small hooks; suckers armed with several transverse rows of hooks; genital pores irregularly alternate. Type species: *O. proteus* Friis, 1869. Development unknown.

Hosts: Birds.

No members of this genus are known from domesticated birds or from very closely allied wild birds, but two species, *O. proteus* Friis, 1869 (Syn. 1875, *O. Lacazii* Villot), and *O. insignis* Lönnberg, are described from wild birds.

Infundibulum divided into 5 parts; strobila 10mm to 25mm long, with about 19 segments; hooks on suckers arranged in three rows; found in *Tringa alpina, Charadrius hiaticula, Calidris arenaria, Larus canus, Limosa rufa*..... *O. proteus.*

Infundibulum not divided, but its border undulated; strobila 50mm to 100mm and more long; found in *Hæmatopus ostrealegus*..... *O. insignis.*

GENUS INCERT. TÆNIA S. L.

A number of other tapeworms have been described from domesticated fowls, but their generic position can not be determined with the data at hand.

27. Tænia cantaniana Polonio, 1860.

[Pl. XX, fig. 256.]

Polonio (1860, pp. 21–22) describes a supposed new species of tapeworm as follows:

1. *T. Cantaniana* Polonio. Caput globosum, centro umbonatum; acetabulis cruciatim oppositis ob majorem capitis circulum; collum nullum; corpus retrorsum dilatatum, articulis supremis campanæformibus, sequentibus campanæformibus imbricatis trapezoidalis; aperturæ genitales marginales. Long, 0.013.

Habitaculum: *Meleagris Gallopavo,* in intestina, Octobri, Patavi (Polonio).

In his second paper (1860, p. 221) this form is cited and is figured on Taf. VII, 2 (vide Pl. XIX, fig. 256 of this paper). The pores are evidently unilateral. Von Linstow (1878, p. 122) includes this among the parasites of the pheasant *Phasianus colchicus,* but does not give his authority.

All subsequent remarks upon this species are based upon Polonio's statements. Blanchard (1891B pp. 439–440) thinks this form may possibly belong to the genus *Davainea,* and takes the following characters from Polonio's figure:

Suckers large and round; the head seems to be surmounted by a very short rostellum, probably retractile. The neck is quite long, distinctly separated from the head. Segments number about 60. Genital pores unilateral; cirrus pouch visible in twenty-sixth to forty-fifth segments; forty-sixth to sixtieth segments are gravid. The eggs, so far as can be judged from the figure, are scattered and isolated as in *D. proglottina.*

I can not see that Polonio's description and figure are sufficient to compel or even to allow the recognition of this specific name. If the types can be obtained and restudied, it would of course be proper to redescribe them under the specific name *cantaniana,* but until those types can be found it is useless to waste time speculating as to the possible generic or specific relations of the parasite. I propose to ignore the species entirely, on the ground that the specific name has not been accompanied by a recognizable description or figure.

28. Tænia Delafondi Railliet, 1892.

(1891, "*Tænia sphenocephala* Rud.," 1810, of Mégnin.)

[Pl. XX, figs. 257–262.]

Diagnosis: Strobila 7^{cm} to 13^{cm} long, 3^{mm} to 4^{mm} broad. Head hemispherical, rostellum and hooks absent. Suckers large. Neck 0.5^{mm} or more long, at first as broad as head, enlarging distally. Proximal segments very short, following segments slightly longer and very broad, lateral margins convex. Genital pores irregularly alternate, situated near the anterior quarter of the lateral border; two lateral ramefied uteri visible as two longitudinal rows of opaque spots; another submedian series formed by receptaculum seminis; testicles rather numerous. Ova globular 62 μ to 65 μ; hooks of oncosphere 11 μ long. Development: Unknown.

Type specimens: In Alfort collection.

Hosts: Domestic pigeons (*Columba livia domestica*) by Delfond, Railliet, Mégnin, and von Linstow. Geographical distribution: France and Germany.

This appears to be a very peculiar form. Its systematic position, as well as its synonymy and anatomy, seem to me extremely uncertain.

29. Tænia exilis Dujardin, 1845.

Dujardin proposed this name for a tapeworm found in chickens, but the description is so insufficient that the species should be ignored entirely. The original description reads:

"Je proposerai de nommer Tænia exilis un autre tænia de la poule, bien différent aussi des précédents, mais dont je n'ai pas encore eu la tête; il est long de 20mm à (?), large de 0.15mm en avant, et de 0.95mm en arrière, formé d'articles courts, transverses; les orifices génitaux sont unilatéraux; les pénis sont lisses, assez longs, larges de 0.015mm précédés par une ample vésicule séminale, remplie des spermatozoïdes en écheveau; les œufs, presque globuleux, ont trois envoloppes; l'externe longue de 0.056mm à 0.065mm; la moyenne de 0.054mm; l'interne de 0.032mm; l'embryon, long de 0.025mm, a des crochets long de 0.0125mm."

Airloing (1875, pp. 427–431) claims to have found the same worm, although it is not at all evident why he should think his form identical with Dujardin's species. He gives the following characters:

Head is 0.48mm long by 0.60mm broad, suckers orbicular 0.20mm diameter; rostellum short 43 μ in diameter, with a simple crown of 60 hooks 8 μ long; neck 5mm long by 0.15mm broad; segments much broader than long; anterior segments 0.33mm to 0.37mm by 49 μ to 50 μ, then 1mm by 0.12mm; middle segments 1.5mm (anterior border) to 1.8mm (posterior border) by 0.6mm. Genital pores unilateral in anterior third of segment. Penis 36 μ by 6 μ. Eggs globular, outer membrane 58 μ to 64 μ, inner membrane 30 μ to 32 μ; hooks of oncosphere 16 μ.

30. Tænia imbutiformis Polonio, 1860.

(1893, *Mesocestoides imbutiformis* (Polonio, 1860) Railliet.)

[Pl. XX, fig. 263.]

Diagnosis: 8mm long, head small, suckers circular. Neck absent. Posterior portion of strobila thick, anterior segments linear; following segments bell or funnel shaped; posterior segments bell-shaped. Genital pores situated on one of the surfaces of the segments. Development: Unknown.

Hosts: Wild geese (*Anser anser*) by Polonio, 1860; von Linstow (1878, p. 155) records it in domesticated ducks (*Anas boschas dom.*), but I can not trace his authority.

Geographical distribution: Padua (by Polonio). Polonio is apparently the only author who has seen this worm.

Polonio (1860A, p. 22) gives the following as original diagnosis:

3. *T. imbutiformis* Polonio. Corpus retrorsum incrassatum; caput minimum; acetabulis orbicularibus anticis; collum nullum; articuli supremi lineares, posteriores campanulato-imbutiformes, ultimi campanulati, aperturæ genitales laterales ellipticæ. Long, 0.01.

Habitaculum: *Anser ferus,* in intestinis, Octob. et Nov. Patavii (Polonio).

Polonio (1860B, p. 121) simply mentions the parasite in his list, and gives a very unsatisfactory figure of the worm. In this figure a prominent body near the lateral margin is looked upon as the genital pore. This body has much more the appearance of a testicle, cirrus pouch, or of a receptaculum seminis than it has of a genital pore. I am therefore inclined to doubt very much whether this species is correctly placed by Railliet (1893, pp. 313-314) in the genus *Mesocestoides.* Furthermore, the form is altogether too insufficiently described to be recognizable. The figure shows extreme contraction near the head.

31. Tænia megalops Nitzsch, 1829.

(1825, *Tænia anatis marilæ* Creplin.)

[Pl. XX, figs. 264–267.]

Diagnosis: Strobila up to 52mm long by 0.5mm broad proximally, and 0.75mm broad distally. Head very large, rather tetragonal, 1.4mm broad; suckers 0.57mm to 0.64mm in diameter; rostellum absent (?) or not prominent and (?) without hooks. Anterior segments very short, 12 times as broad as long; posterior segments twice as broad as long, "narrowed at the base, spread in form of a bell," colored yellowish by small longitudinal lines. Genital pores unilateral. Penis smooth, tubular, 70 μ by 23 μ "situated on a very prominent and swollen tubercle." Ova globular with 2 membranes; outer membrane 47 μ, inner 38 μ in diameter; oncosphere 32 μ; hooks 15 μ; the eggs are scattered through the median portion of the segments. Development: Unknown.

Hosts: Tame duck (*Anas boschas dom.*); Brazilian teal (*A. braziliensis*); European teal (*A. crecca*); pintail (*Dafila acuta*); white-headed duck (*Erismatura leucocephala*); tufted duck (*Aythya fuligula*); European scaup duck (*A. marila*); African teal (*A. nyroca*).

The chief character for this worm is the large head, but it seems extremely doubtful whether this should be taken as the basis of a species. The parasite certainly can not be recognized with certainty from the present description, and should be considered as a doubtful species until some of the original specimens can be restudied.

32. Tænia nigropunctata Crety, 1890.

[Pl. XX, figs. 268–270.]

Diagnosis: Strobila to 140mm in length. Head small, 0.382mm broad; (?) rostellum and hooks absent; suckers 0.166mm by 0.137mm. Neck short, about same breadth as head. Young segments rectangular, 0.5mm long by 1mm broad; older segments almost quadrangular, 2mm long by 1.5mm broad; mature segments 2.5mm to 3mm long by 1mm broad. Genital pores irregularly alternate, slightly posterior to the middle of the margin. *Male genitalia:* in posterior portion of segment, testicles 12 in number, diameter 58 μ, equally distributed at sides of the uterus; vas deferens convoluted in its lateral portion and inflated to vesicula seminalis 0.176mm by 0.098mm within the cirrus pouch; cirrus pouch pyriform, 0.313mm by 0.137mm. *Female genitalia:* Ovary vitellogene gland, shell gland? At anterior border of the segment a spot is observed in the median line; from this a median stem runs distally and is divided near the height of the pore into two portions; the posterior portion, at least, represents the uterus. Ova 62 μ, with 3 shells; oncosphere 46 μ by 40 μ; hooks 15 μ.

Host: Migratory quail (*Coturnix coturnix*).

33. Tænia sp. Conard, MS.

[Pl. XXI, figs. 275–276.]

Mr. Henry S. Conard (Haverford College) has recently studied some tapeworms from chickens, evidently finding more than one species. He has kindly placed the following abstract of his work upon one of these forms at my disposal, prior to the publication of his article.

Head round-conical, somewhat four-angled, broader than long (0.098mm to 0.136mm long; 0.11mm to 0.192mm broad). Acetabula round to elliptical, 0.06mm in diameter, directed slightly forward. Neck distinct, terete, 0.5cm long. Proglottides trapezoidal, broader than long. Genital apertures marginal, always on the right-hand side of the segment, slightly in front of the middle. The male organs comprise a

testis; vesicula seminalis, cirrus sac and cirrus, vesicula and cirrus being the most prominent organs of the whole segment. Cirrus very short, roughened with minute prickles about perpendicular to its surface. Female organs consist of a narrow vagina, large receptaculum seminis, and a common ovary and uterus (See von Linstow, 1893). Vagina and cirrus sac are in the same transverse plane and pass dorsad to both longitudinal canals. Length 35^{mm}; breadth 0.046^{mm} to 0.47^{mm}; thickness 0.046^{mm} to 0.113^{mm}. Number of segments about 600, becoming as much as 0.39^{mm} long. Egg about 0.026^{mm} in diameter; embryos ellipsoidal, 0.016^{mm} by 0.0225^{mm}; hooks about 0.008^{mm} long.

Hab: In small intestine of common fowl, shortly back of gizzard.

Mr. Conard looks upon this form as a species of *Davainea* "with unilateral pores," although he has not as yet found any hooks upon the head. Final decision regarding the form must be reserved until the appearance of Mr. Conard's paper.

FIMBRIARIA Frölich, 1802.

(1892, *Epision* Linton.)

[Pl. XXI, fig. 271.]

This genus was proposed first by Frölich, and later by Linton, for tapeworms with an anterior hammer-like extremity. The scolex is generally (? always) wanting. Three species *F. malleus* (Goeze, 1782) Frölich, *F. mitrata*, and *E. plicatus* have been described, but most authors include them all under the general term *Tænia malleus*, which some writers look upon as a pathological condition rather than a distinct species or genus.

34. *F. malleus* has been recorded from a large number of wild birds as well as from domesticated fowls, but so far as known it does not play any important pathogenic rôle. (See Dujardin, 1845, p. 587, for the earlier literature.)

IDIOGENES Krabbe, 1868.

[Pl. XXI, figs. 272–274.]

The genus *Idiogenes* with the type and only species *I. otidis* was proposed by Krabbe for a tapeworm in which the scolex is wanting; the anterior segments become caliciform and function as a pseudo-scolex. (For an anatomical description see Zschokke, 1889, pp. 114–127, Pl. III, figs. 39–47.)

This avian tapeworm had not yet been recorded from poultry.

ADDENDUM.

During the final proof reading of this paper, I have received a recent article by Railliet (1896), in which several new propositions are made concerning certain parasites mentioned in this report.

Dipylidiinæ: The name of the subfamily, *Cystoidotæniæ*, is changed to *Dipylidinæ*. This change is in accordance with the International Code and should be adopted, the word, however, being written *Dipylidiinæ*.

Choanotænia: Railliet proposes a new genus, with *Tænia infundibuliformis* Goeze as type, in the following words:

Le *Tænia infundibuliformis* Goeze, que j'avais placé provisoirement dans le genre *Drepanidotænia*, s'en distingue par le grand nombre des testicules, et d'une manière

| | | HOSTS. | TÆNIIDÆ. | | |

générale par la constitution de l'appareil reproducteur (Crety). Il mérite donc de devenir le type d'un nouveau genre *Choanotænia* (de χόανον entonnoir). *Ch. infundibuliformis*, intestin de la poule. (P. 159.)

Although I recognized the great difference in organization between *T. infundibuliformis* (as described by Crety) and the other species of *Tænia* which have been placed in *Drepanidotænia*, and am inclined to consider it generically distinct from these worms (see p. 45), and although I have the highest regard for the opinion of my colleague and for his keen foresight, particularly in systematic questions, I prefer to reserve judgment upon his new genus until its type species and a few allied forms are more thoroughly understood, especially as it appears to me that *T. infundibuliformis*, as determined by various authors, is rather a heterogenous and collective species.

Dicranotænia sphenoides: Railliet correctly suppresses the specific name *cuneata* Linstow nec Batsch (see p. 35).

EXPLANATION OF CHART.

In the following chart I have given the records of the tapeworms found in the domesticated poultry and in the allied wild birds. The sign □ signifies that the parasite is recorded only for domesticated birds, × for wild birds, ⊞ both domesticated and wild birds.

The names of the hosts are given at the left, those of the parasites at the top. The first row of numbers refers to the numbers in the A. O. U. check list of North American birds, the second column of numbers to the corresponding numbers in von Linstow's Compendium of Helminthology (1878, 1889).

For the revision of the host names I am indebted to Drs. Fisher and Palmer, of the Division of Ornithology. As many of the host names used by helminthologists are not used by modern ornithologists, these gentlemen have traced out the proper names of the birds in question from the host names given in helminthological articles.

In noting the species of parasites under the various hosts, it has been extremely difficult to determine what records should be accepted and what ones should be rejected. As nearly all of the older records are based upon determinations by external form instead of internal anatomy, I believe the time has come when we should begin an entirely new series of records of hosts.[1]

All records of tapeworms, except in the case of type specimens where the determination has been made solely upon external form, should, I believe, be taken only as approximate and provisional.

---

[1]This can easily be accomplished if helminthologists will designate all new records in some way. In the Revision of the Adult Cestodes of Cattle, Sheep, and Allied Animals, and also in my recent article on *Fasciola magna*, I have commenced such a new series of host determinations for the parasites of the domesticated animals by starring (*) the parasites under each host in those cases where I have examined the species of parasites from the host in question (or from material said to have come from that host, as *T. denticulata*, for instance. This latter record is, in my opinion, erroneous.)

DESCRIPTION OF PLATES.

PLATE I, FIGS. 1–11.—*Cotugnia digonopora.*

Fig. 1. Head and neck. x8.
Fig. 2. Head and neck in press preparation. Zeiss 2, A.
Fig. 3. View of armed rostellum, *en face*, press preparation; *cgl.*, ? glandular cells of rostellum. Zeiss 3, C.
Fig. 4. View of hooks on rostellum. Zeiss 2, $\frac{1}{12}$.
Fig. 5. Side view of isolated hook. Zeiss 3, $\frac{1}{12}$.
Fig. 6. Four young segments with genital anlagen. x8.
Fig. 7. Three young segments: *d.*, vas deferens; *ov.*, ovary. Zeiss, 1, a^3.
Fig. 8. Segments from middle of strobila, with organs more completely developed: *d.*, vas deferens; *t.*, testicles; *tp.*, cirrus pouch; *ov.*, ovary. Zeiss 1, a^3.
Fig. 9. Still older segments in which the "ovaric capsules" (=egg sacs) are developing: *ag.*, genital pore; *co.*, "ovaric capsules"=egg sacs; *d.*, vas deferens; *ov.*, ovary; *p.*, cirrus; *tp.*, cirrus pouch; *v.*, vagina. Zeiss 1, a^3.
Fig. 10. End segments with oncosphere: *ag.*, genital pore; *co.*, eggs.
Fig. 11. Longitudinal section of mature segment: *co.*, "ovaric capsules"=egg sacs; *em.*, oncosphere; *ie*, eggshell; *g.*, eggshell; *pr.*, parenchyma. Zeiss 2, $\frac{1}{12}$.
All figures from Pasquale, 1890, figs. 1–11.

PLATE II, FIGS. 12–20.—*Cotugnia bifaria* and *Amabilia lamelligera.*

[Figs. 12–17. *Cotugnia bifaria*, after Monticelli, 1891, Taf. VIII, figs. 8–13.]

Fig. 12. Head and anterior segments, greatly enlarged. Monticelli, fig. 8.
Fig. 13. Young segments, enlarged on same scale. Monticelli, fig. 9.
Fig. 14. Middle segments, enlarged on same scale. Monticelli, fig. 10.
Fig. 15. End segments, enlarged on same scale. Monticelli, fig. 11.
Fig. 16. Segment mounted in glycerin and acetic acid, showing genital organs: *ag.*, genital pore; *df.*, vas deferens; *ov.*, ovary; *rse.*, vesicula seminalis; *t.*, testicles; *v.*, vagina. Greatly enlarged. Monticelli, fig. 12.
Fig. 17. Armed cirrus, greatly enlarged. Monticelli, fig. 13.

[Figs. 18–20. *Amabilia lamelligera.* Owen's (1835) original figures.]

Fig. 18. Adult strobila, natural size. Owen's fig. 21.
Fig. 19. "Four segments of the same magnified." Owen's fig. 22.
Fig. 20. "Longitudinal section of 3 posterior segments, showing the ova collected near the base of the lemniscus." Owen's fig. 23.

PLATE III, FIGS. 21–36.—*Dicranotænia coronula, Dicranotænia æquabilis, Dicranotænia furcigera,* and *Tænia conica.*

[Figs. 21–28. *Dicranotænia coronula:* 21–24 after Krabbe, 1869; 25–28 after Mrázek, 1890.]

Fig. 21. Anterior portion of scolex with hooks. x240. After Krabbe, 1869, Tab. VIII, fig. 216. Host: Domesticated duck.
Fig. 22. Isolated hook. x920. After Krabbe, 1869, Tab. VIII, fig. 217.

Fig. 23. Isolated ovum with oncosphere. x240. After Krabbe, Tab. VIII, 1869, fig. 218.

Fig. 24. Isolated hook. x920. After Krabbe, 1869, Tab. VIII, fig. 219. From Coll. Siebold. Host: European golden eye (*Glaucionetta clangula*).

[Figs. 25–28. Cysticercoids from *Cypris ovum* and *C. compressa*.]

Fig. 25. Fully developed larva, showing the scolex invaginated in the cyst; and the long tail with the 6 oncospheric hooks; *ex.*, excretory system; *h.*, cuticle; *cu.*? "pores of the cuticle" or ? muscles; *hp.*, hypodermis; *p.*, parenchyma of neck, with calcareous corpuscles. After Mrázek, 1890, Tab. V, fig. 11.

Fig. 26. Another view of a cysticercoid. After Mrázek, 1890, Tab. V, fig. 12.

Fig. 27*a–c*. Isolated hooks. After Mrázek, 1890, Tab. V, fig. 13*a–c*.

Fig. 28*a–c*. Oncospheric hooks. After Mrázek, 1890, Tab. V, fig. 14*a–c*.

[Figs. 29–30. *Dicranotænia æquabilis*.]

Fig. 29. Five hooks from the rostellum. x240. After Krabbe, 1869, Tab. VIII, fig. 212, from Rudolphi's original material in the Berlin Museum.

Fig. 30. Isolated hook from the rostellum. x920. After Krabbe, 1869, Tab. VIII, fig. 213, from specimen in Creplin's collection.

[Figs. 31–34. *Dicranotænia furcigera*.]

Fig. 31. Isolated hook from the rostellum. x210. After Dujardin, 1845, Pl. IX. Fig. A. Host: Wild duck.

Fig. 32. Isolated hook from the rostellum. x920. After Krabbe, 1869, Tab. VIII, fig. 206, from Nitzsch's original material. (See Rudolphi, 1819, p. 528.) Host: Mallard.

Fig. 33. Ovum with oncosphere. x240. After Krabbe, 1869, Tab. VIII, fig. 207, from Nitzsch's original material.

Fig. 34. Ten hooks on rostellum. x240. After Krabbe, 1869, Tab. VIII, fig. 205, from material collected in Iceland in 1863. Host: Mallard.

[Fig. 35–36. *Tænia conica*=? *Dicranotænia furcigera*.]

Fig. 35. Natural size: *a*, head; *b*, rostellum; *c*, body. After Molin, Tab. VII, fig. 1.

Fig. 36. Enlarged. After Molin, 1861, Tab. VII, fig. 2.

PLATE IV, FIGS. 37–53.—*Dicranotænia sphenoides* and *Drepanidotænia lanceolata*.

Figs. 37–42. *Dicranotænia sphenoides*.

Fig. 37. Strobila, natural size. After von Linstow, 1872, Taf. III, fig. 9*a*, of *Tænia cuneata*.

Fig. 38. Scolex and anterior segments, enlarged. After von Linstow, 1872, Taf. III, fig. 9, of *T. cuneata*.

Fig. 39. Isolated hook from the rostellum. After von Linstow, 1872, Taf. III, fig. 10, *T. cuneata*.

Fig. 40. Cysticercoid from an earthworm. Koritska, *oc.* 3, *obj.* 4. After Grassi & Rovelli, 1892, Tav. IV, fig. 12.

Fig. 41. Tranverse section of the same: *cav.*, "cavity of the gastrula;" *cis.*, cyst; *par. est.*, external wall; *par. int.*, internal wall; *ros.*, rostellum; *ven.*, sucker. Koritska, *oc.* 3, *obj.* 7. After Grassi Rovelli, 1892, Tav. IV, fig. 11.

Fig. 42. Three hooks (*b*, *c*, and *d*) from rostellum of *T. cuneata;* Koritska, *oc.* 3, *obj.* 8; a fourth hook (*a*) greatly enlarged. After Grassi & Rovelli, 1892, Tav. IV, fig. 13.

[Figs. 43–53. *Drepanidotænia lanceolata.*]

Fig. 43. Original type figure. After Bloch, 1782, Tab. I, fig 5.
Fig. 44. Anterior portion, enlarged. After Bloch, 1782, Tab. I, fig. 6.
Fig. 45. Worm from a goose. Natural size. After Goeze, 1782, Tab. XXIX, fig. 3.
Fig. 46. The eight hooks upon the rostellum. x240. After Krabbe, 1869, Tab. VI, fig. 143.
Fig. 47. Two isolated hooks. x920. After Krabbe, 1869, Tab. VI, fig. 144.
Fig. 48. Extruded cirrus. After Feuereisen, 1868, Taf. X, fig. 8.
Fig. 49. Cirrus pouch with cirrus. After Feuereisen, 1868, Taf. X, fig. 9.
Fig. 50. Isolated segment: *a*, cirrus pouch; *c*, testicle; *i*, vitellogene gland; *k*, ovary; *m*, receptaculum seminis and vagina. After Feuereisen, 1868, Taf. X, fig. 17. Some misinterpretations have undoubtedly been made in this figure. The genital system must be restudied.
Fig. 51. Head and anterior segments. x100. After Railliet, 1886, fig. 163A; also Railliet, 1893, fig. 195A.
Fig. 52. Ovum with oncosphere. x300. After Railliet, 1886, fig. 163B; also Railliet 1893, fig. 195 B.
Fig. 53. Head and anterior segments. x100. After Mégnin, 1881, Pl. IV, fig. 3.

PLATE V, FIGS. 54–66.—*Drepanidotænia lanceolata* and *Drepanidotænia fasciata.*

[Figs. 54–55. *Drepanidotænia lanceolata.*]

Fig. 54. Transverse section of segment. x20. After Mégnin, 1881, Pl. IV, fig. 6.
Fig. 55. Isolated cirrus. x50. After Mégnin, 1881, Pl. IV, fig. 7.

[Figs. 56–66. *Drepanidotænia fasciata.*]

Fig. 56. Rostellum with 5 of the 8 hooks. x240. After Krabbe, 1869, Tab. VII, fig. 156.
Fig. 57. Isolated hook. x920. After Krabbe, 1869, Tab. VII, fig. 157.
Fig. 58. Head with extended rostellum possessing 8 hooks. After Feuereisen, 1868, Taf. X, fig. 1. (*"T. setigera" = Drep. fasciata.*)
Fig. 59. Isolated hook. After Feuereisen, 1868, Taf. X, fig. 2. (*"T. setigera" = Drep. fasciata.*)
Fig. 60. Cirrus pouch. After Feuereisen, 1868, Taf. X, fig. 4. (*"T. setigera" = Drep. fasciata.*)
Figs. 61–62. Cirrus from above and from the side. After Feuereisen, 1868, Figs. 5, 6. (*"T. setigera" = Drep. fasciata.*)
Figs. 63–66. Isolated segments: *a*, cirrus pouch; *b*, genital pore; *c*, testicles; *d*, cirrus; *e*, vas deferens and vesicula seminalis; *g*, vagina; *h*, genital cloaca; *i*, vitellogene glands; *k*, ovary; *m*, receptaculum seminis; *n*, uterus (?). After Feuereisen, 1868, Taf. X, figs. 10–13. Feuereisen has probably misinterpreted some of these organs and they should be restudied.

PLATE VI, FIGS. 67–76.—*Drepanidotænia fasciata.*

Fig. 67. Body of *Cyclops agilis*, containing a larval tapeworm. After Mrázek, 1890, Tab. V, fig. 1.
Fig. 68. Larval tapeworm, with enormously long tail, isolated from the crustacean. After Mrázek, 1890, Tab. V, fig. 2.
Fig. 69. (? Side view.) After Mrázek, 1890, Tab. V, fig. 3.
Fig. 70. Cysticercoid, with anterior portion of the tail. After Mrázek, 1890, Tab. V, fig. 5.
Figs. 71–72. Hooks from rostellum, greatly magnified. After Mrázek, 1890, Tab. V, figs. 7–8.

Figs. 73–75. Hooks as seen in position on the rostellum. After Mrázek, 1890, Tab. V, figs, 6 and 9*a–b*.

Fig. 76. After Mrázek, 1890, Tab. V, fig. 10.

PLATE VII, FIGS. 77–91.—*Drepanidotænia fasciata* and *Drepanidotænia gracilis*.

[Figs. 77–79. *Drepanidotænia fasciata*.]

Fig. 77. Cysticercoid with anterior portion of tail. After Mrázek, 1890, Tab. V, fig. 4.

Fig. 78. Cysticercoid with extended head; the oncospheric hooks are still visible in the tail. After Mrázek, 1891, Tab. V, fig. 1.

Fig. 79. Isolated hook from rostellum. After Mrázek, 1891, Tab. V, fig. 2.

[Figs. 80–91. *Drepanidotænia gracilis*.]

Fig. 80. "*Tænia collo longissimo*." After Bloch, 1872, Taf. III, fig. 3. Is perhaps identical with *Drep. gracilis*.

Fig. 81. Head of same, enlarged. After Bloch, 1782, Taf. III, fig. 4.

Fig. 82. Anterior portion of head, showing the arrangement of the 8 hooks upon the rostellum. x240. After Krabbe, 1869, Tab. VII, fig. 154.

Fig. 83. Isolated hook. x920. After Krabbe, 1869, fig. 155.

Fig. 84. Strobila, natural size. After von Linstow, 1872A, Taf. XXI, fig. 3. Host: Goosander.

Fig. 85. Head. x90. After von Linstow, 1872A, Taf. XXI, fig. 5.

Fig. 86. Isolated hook. x500. After von Linstow, 1872A, Taf. XXI, fig. 2.

Fig. 87. End of proglottid with extruded cirrus. x150. After von Linstow, 1872A, Taf. XXI, fig. 4.

Fig. 88. Head of *Tænia gracilis tadornæ* from the common sheldrake (*Tadorna tadorna*). After Lönnberg, 1889, Pl. I, fig. 1.

Fig. 89. Free cysticercoid in the perch (*Perca fluviatilis*). x350. After von Linstow, 1872A, Pl. XXI, fig. 1.

Fig. 90. Excretory system of the head and neck. After Mrázek, 1891, Tab. V, fig. 16. Zeiss 3, D.

Fig. 91. End cell of excretory system. After Mrázek, 1891, Tab. V, fig. 17. Zeiss 3, F.

PLATE VIII, FIGS. 92–99.—*Drepanidotænia gracilis*.

Fig. 92. A cysticercoid in process of development. A differentiation is noticed into the body and the tail, and a small knob is noticed on the anterior extremity. The 6 oncospheric hooks are present in the tail. After Mrázek, 1891, Tab. VI, fig. 25.

Fig. 93. Another stage of the cysticercoid. An invagination is noticed on the anterior extremity; the middle portion of the body is occupied by a cavity filled with a spongy tissue. After Mrázek, 1891, Tab. VI, fig. 26.

Fig. 94. Cysticercoid with the anterior portion of the tail: *h.*, peripheral hyaline layer; *e.*, excretory canals; *pr.*, vibratory cells (see Pl. VII, fig. 86), "Pronephridiostomes." Zeiss 3, D. After Mrázek, 1891, Tab. V, fig. 13.

Fig. 95. Normal form of hook. Zeiss 3, F. After Mrázek, 1891, Tab. V, fig. 14.

Figs. 96–98. Three hooks, with variously arranged chitin. Zeiss 3, D. After Mrázek, 1891, Tab. V, fig. 15*a–c*.

Fig. 99. A cysticercoid with extended head: *r.*, rostellum; *c.*, cyst; *pr.*, tail with oncospheric hooks. Zeiss 1, D. After Mrázek, 1891, Tab. VI, fig. 18.

PLATE IX, FIGS. 100–111.—*Drepanidotænia anatina*.

Fig. 100. Rostellum with 5 of the 10 hooks. x240. After Krabbe, 1869, Tab. VI, fig. 114.

Fig. 101. Isolated hook. x920. After Krabbe, 1869, Tab. VI, fig. 115.

Fig. 102. Ovum. x240. After Krabbe, 1869, Tab. VI, fig. 116.

Fig. 103. Transverse section of a portion of one segment, to show the anatomy: *h.*, testicles; *vd.*, vas deferens; *bk.*, fertilization canal; *ut.*, uterus; *lm.*, longitudinal muscles; *s. bl.*, vesicula seminalis; *gz.*, ganglion cells; *p. s.*, præputial sac; *c.*, cirrus; *cb.*, cirrus pouch; *l. k.*, longitudinal canals; (small dorsal canal; large ventral canal); *r. sem.*, receptaculum seminis; *ov.*, ovary; *eig.*, oviduct; *d. st.*, vitellogene gland; *d. g.*, vitello-duct; *sch. dr.*, shell gland; *af.*, canal of same. After Schmidt, 1894, Taf. VI, Fig. C.

Fig. 104. Ovum with oncosphere. After Schmidt, 1894, Taf. VI, fig. 1.

Fig. 105. The oncosphere has developed into a round mass in which a cavity appears. After Schmidt, 1894, Taf. VI, fig. 2.

Fig. 106. Stage in which the round mass has become elongate; *ebl.*, terminal vesicle. After Schmidt, 1894, Taf. VI, fig. 3.

Fig. 107. Stage with anlage of the rostellum and suckers; the body has become constricted into the scolex, cyst, and tail; the excretory system is partly developed. After Schmidt, 1894, Taf. VI, fig. 4.

Fig. 108. Transverse section in the second period of development. After Schmidt, 1894, Taf. VI, Fig. *a*.

Fig. 109. Longitudinal section of a later stage of the second period of development. After Schmidt, 1894, Taf. VI, Fig. *b*.

Fig. 110. Extended cysticercoid; *s.*, anterior point of rostellum; *r.*, rostellum; *ex.*, excretory organ; *h. r.*, posterior rostellum sac; *ebl.*, terminal vesicle. After Schmidt, 1894, Taf. VI, Fig. B.

Fig. 111. Two isolated hooks from the rostellum. After Mrázek, 1891, Tab. VI, fig. 20.

PLATE X, FIGS. 112–124*b*.—*Drepanidotænia anatina* and *Drepanidotænia sinuosa*.

[Figs. 112–115. *Drepanidotænia anatina*.]

Fig. 112. Cysticercoid with anterior portion of the tail: *rm.*, circular muscles; *p.*, (third), parenchymatic layer; *h.*, fourth layer = neck; *hr.*, posterior rostellum sac; *r.*, rostellum; *ex.*, excretory system. After Schmidt, 1894, Taf. VI, Fig. A.

Fig. 113. Cysticercoid with anterior portion of the tail: *h.*, peripheral layer; *ku.*, cuticle; vl^1., muscular fibers; pch^1., parenchymatic layer; vl^2., second layer of fibers; pch^2., internal parenchymatic layer (= neck) with calcareous corpuscles (*v*); *e.*, excretory apparatus; *pr.*, caudal appendage; *j.*, nuclei of cells in the tail; *hc.*, hooks of oncosphere. Zeiss 3, D. After Mrázek, 1891, Tab. VI, fig. 19.

Fig. 114. Isolated young hook. After Mrázek, 1891, Tab. VI. fig. 21.

Fig. 115. Ten hooks taken from the outline of cyst of cysticercoid, showing the hooks in position on the rostellum. After Mrázek, 1891, Tab. VI, fig. 22.

[Figs. 116–124*b*. *Drepanidotænia sinuosa*.]

Fig. 116. A young worm, natural size. After Zeder, 1800, Tab. III, fig. 5.

Fig. 117. Distal end of a young worm enlarged: *a*, *b*, two knobs. After Zeder, 1800, Tab. III, fig. 6.

Fig. 118. An adult worm, natural size. After Zeder, 1800, Tab. III, fig. 7.

Fig. 119. Short segments enlarged. After Zeder, 1800, Tab. III, fig. 8.

Fig. 120. Scolex enlarged: *f*, the long rostellum with hooks; *c c*, *d d*, suckers; *a a*, *b b*, neck. After Zeder, 1800, Tab. III, fig. 9.

Fig. 121. Two large segments, enlarged: *a a*, *b b*, the "vermiform sacs;" *c c*, cirri; *d*, posterior corners of the segments. After Zeder, 1800, Tab. III, fig. 10.

Fig. 122. Isolated eggs, enlarged. After Zeder, 1800, Tab. III, fig. 11.

Fig. 123. Rostellum of *Drep. sinuosa*. x240. After Krabbe, 1869, Tab. VII, fig. 151.

Fig. 124. Two isolated hooks. x920. *a*, from a parasite in the domesticated duck; *b*, from a parasite in the mallard. After Krabbe, 1869, Tab. VII, fig. 152*a–b*.

PLATE XI, FIGS. 125–139.—*Drepanidotænia sinuosa.*

Fig. 125. Segment with genital organs and extruded cirrus. x35. After Krabbe, 1869, Tab. VII, fig. 153.

Fig. 126. Bloch's original figure of "*Tænia collari nigro*," from the domesticated duck; possibly identical with *Drep. sinuosa*. After Bloch, 1782, Taf. IV, fig. 11.

Fig. 127. Anterior portion of the same, enlarged. After Bloch, 1782, Taf. IV, fig. 12.

Fig. 128. Segments from the middle of the same, enlarged. After Bloch, 1782, Taf. IV, fig. 13.

Fig. 129. Cirrus. x210. After Dujardin, 1845, Pl. 9, Fig. D. Host: Goose.

Fig. 130. A *Cyclops viridis* containing 3 cysticercoids of *Drep. sinuosa: vc.*, eggs. Zeiss 3, A. After Mrázek, 1891, Tab. V, fig. 7.

Fig. 131. Isolated cysticercoid, to show the proportional sizes of the cyst and the tail. Zeiss 3, A. After Mrázek, 1891, Tab. V, fig. 8.

Fig. 132. Isolated hook, greatly enlarged. Zeiss 3, F. After Mrázek, 1891, Tab. V. fig. 10.

Fig. 133*a–c*. Young stages of hooks. Zeiss 3, F. After Mrázek, 1891, Tab. V, fig. 11.

Fig. 134. Two isolated hooks of a cysticercoid which otherwise corresponds in form to *Drep. sinuosa*. The form and size (35 μ) of these hooks resemble those of *Drep. setigera*. Zeiss 3, F. After Mrázek, 1891, Tab. V, fig. 12.

Fig. 135. Cysticercoid with anterior portion of tail, drawn from life. Zeiss 3, D. After Mrázek, 1891, Tab. V, fig. 9.

Fig. 136. Two isolated hooks from fully developed scolex of cysticercoid. Zeiss 3, F. After Hamann, 1889, Taf. I, fig. 9.

Fig. 137. The 10 hooks of the rostellum in position. Zeiss 3, F. After Hamann, 1889, Taf. I, fig. 10.

Fig. 138. Calcareous corpuscles from the parenchyma of the scolex. Zeiss 3, F. After Hamann, 1889, Taf. I, fig. 11.

Fig. 139. A hook of the oncosphere from the tail of a cysticercoid. After Hamann, 1889, Taf. I, fig. 12.

PLATE XII, FIGS. 140–152.—*Drepanidotænia sinuosa, Drepanidotænia setigera*, and *Tænia Krabbei* Kowalewski *nec* Moniez.

[Figs. 140–146. *Drepanidotænia sinuosa.*]

Figs. 140–142. Three successive stages in the development of the cysticeroid in *Gammarus pulex*. Zeiss 1, A. After Hamann, 1889, Taf. I, figs. 4, 5, 6.

Fig. 143. Median longitudinal section through fig. 140. Zeiss 4, A. After Hamann, 1889, Taf. I, fig. 7.

Fig. 144. Median longitudinal section through a stage nearly corresponding to fig. 142. Zeiss 4, A. After Hamann, 1889, Taf. I, fig. 8.

Fig. 145. Fully developed cysticercoid, surrounded by its tail, *s*, and a cyst *h*. Zeiss 3, A. After Hamann, 1889, Taf. I, fig. 1.

Fig. 146. The same without surrounding cyst. Zeiss 3, A. After Hamann, 1889, Taf. I, fig. 3.

[Figs. 147–150. *Drepanidotænia setigera.*]

Fig. 147. Scolex with 6 of the 10 hooks. x240. After Krabbe, 1869, Tab. VI, fig. 117. Host: Domesticated goose.

Fig. 148. Isolated hook of same. x920. After Krabbe, 1869, Tab. VI, fig. 118.

Fig. 149. Isolated hook from Rudolphi's 1819, p. 700B, "*Tænia sinuosa*" = *Drep. setigera*. x920. After Krabbe, 1869, Tab. VI, fig. 120.

Fig. 150. Cirrus. x240. After Krabbe, 1869, Tab. VI, fig. 119.

[Figs. 151–152. *Tænia Krabbei* Kowalewski nec Moniez.]

Fig. 151. Two isolated hooks of a tapeworm, which Krabbe (1869, p. 290) found in a goose and determined as "*T. setigera?;*" this form has since been described as *T. Krabbei* by Kowalewski, 1895. x920. After Krabbe, 1869, Tab. VI, fig. 121.

Fig. 152. Two isolated hooks from *T. Krabbei* Kowalewski, 1895 [nec Moniez, 1879.] x1000. After Kowalewski, 1895, Tab. VIII, fig. 27.

PLATE XIII, FIGS. 153–164.—*Drepanidotænia sinuosa* and *Drepanidotænia setigera.*

Fig. 153. *Drepanidotænia sinuosa.* Cysticercoid with anterior portion of tail: *a*, *b*, *c*, *d*, layers of the cuticle. Glycerine preparation. Zeiss I, D. After Hamann, 1889, Taf. I, fig. 2. Host: *Gammarus pulex.*

[Figs. 154–164. *Drepanidotænia setigera.*]

Fig. 154. Adult worm, natural size. After Frölich, 1789, Tab. IV, fig. 1.

Fig. 155. Head of same, enlarged, with (*a*) rostellum and (*b*) suckers. After Frölich, 1789, Tab. IV, fig. 2.

Fig. 156. Three young segments of same, greatly enlarged. After Frölich, 1789, Tab. IV, fig. 3.

Fig. 157. Six segments from posterior end, enlarged, with (*a*) extruded or (*b*) partly extruded cirri. After Frölich, 1789, Tab. IV, fig. 4.

Figs. 158–160. Three isolated segments with genital organs: *a*, cirrus pouch; *c*, testicles; *e*, vas deferens with vesicula seminalis; *g*, vagina; *i*, vitellogene gland; *k*, ovary; *m*, receptaculum seminis. After Feuereisen, 1868, Taf, X, figs. 14, 15, 16, of "*Tænia fasciata.*"

Fig. 161. Hook from scolex. After Feuereisen, 1868, Taf. X, fig. 3.

Fig. 162. Transverse section of segment: *p.*, cirrus; *v.*, vagina; *l. m.*, longitudinal muscles; *k.*, excretory (longitudinal) canals; *ov.*, ovary. Hartnack 2, 2. After Lönnberg, 1889, Taf. I, fig. 7.

Fig. 163. Cysticercoid, with very long tail, from *Cyclops brevicaudatus.* After von Linstow, 1892B, fig. 1.

Fig. 164. Hook from the same. After von Linstow, 1892, fig. 2.

PLATE XIV, FIGS. 165–186.—*Drepanidotænia tenuirostris* and *Drepanidotænia infundibuliformis.*

[Figs. 165–172. *Drepanidotænia tenuirostris.*]

Fig. 165. Cysticercoid with tail. x325. After Hamann, 1889, Fig. A. From the body cavity of *Gammarus pulex.*

Fig. 166. Calcareous corpuscles of same. x800. After Hamann, 1889, Fig. B.

Fig. 167. Hooks from the rostellum. x800. After Hamann, 1889, Fig. C.

Fig. 168. Cysticercoid with long tail. Zeiss 3, A. After Mrázek, 1891, Tab. V, fig. 3.

Fig. 169. Cysticercoid with anterior portion of tail. Zeiss 3, D. After Mrázek, 1891, Tab. V, fig. 4.

Fig. 170. Two hooks of same. Zeiss 3, F. After Mrázek, 1891, Tab. V, fig. 5.

Fig. 171. The same, greatly magnified. After Mrázek, 1891, Tab. V, fig. 6.

Fig. 172. Very young stage of cysticercoid of *Drep. tenuirostris* (?). The oncospheric hooks are preserved. After Mrázek, 1891, Tab. VI, fig. 24.

[Figs. 173–186. *Drepanidotænia infundibuliformis.*]

Fig. 173. Goeze's original figure of worm, natural size. After Goeze, 1782, Tab. XXXI, A, fig. 1.

Fig. 174. Head of same, enlarged, showing hooks and suckers. After Goeze, 1782, Tab. XXXI, A, fig. 2.

Fig. 175. Posterior segments, enlarged. After Goeze, 1782, Tab. XXXI, A, fig. 3.
Fig. 176. Posterior segments with eggs, enlarged. After Goeze, 1782, Tab. XXXI, A, fig. 4.
Fig. 177. Eggs, enlarged. After Goeze, 1782, Tab. XXXI, A, fig. 5.
Fig. 178. An inverted piece of chicken's intestine, with numerous tapeworms attached. After Goeze, 1782, Tab. XXXI, A, fig. 6.
Fig. 179. Scolex with hooks. x240. After Krabbe, 1869, Tab. X, fig. 287.
Fig. 180*a–c*. Three isolated hooks. x920. Fig. 180*c* from Küchenmeister's collection. After Krabbe, 1869, Tab. X, fig. 288*a–c*.
Fig. 181. Cirrus. x240. After Krabbe, 1869. Tab. X, fig. 289.
Fig. 182. Egg. x240. After Krabbe, 1869, Tab. X, fig. 290.
Fig. 183. Head of "*T. infundibulum.*" x80. After Cobbold, 1859, Pl. LXIII, fig. 25.
Fig. 184. Rostellum. After Crety, 1890, fig. 5.
Fig. 185. Isolated hooks. After Crety, 1890, fig. 6.
Fig. 186. Mature egg. After Crety, 1890, fig. 8.

PLATE XV, FIGS. 187–198.—*Drepanidotænia infundibuliformis* and *Davainea proglottina.*

[Figs. 187–193. *Drepanidotænia infundibuliformis.*]

Fig. 187. Bloch's "*Tænia articulis convideis.*" After Bloch, 1782, Tab. III, fig. 1.
Fig. 188. Head of same, enlarged. After Bloch, 1782, Tab. III, fig. 2.
Fig. 189. Transverse section of mature proglottid. After Crety, 1890, fig. 15.
Fig. 190. Part of a longitudinal section of the larval stage from the body cavity of a fly: *cav.*, "cavity of the gastrula;" *lac.*, "primitive cavity;" *sco.*, scolex; *ven.*, sucker. Koritska 3, 8. After Grassi & Rovelli, 1892, Tav. IV, fig. 14.
Fig. 191. Cysticercoid partly extended: *par. int.*, internal wall; *par. est.*, external wall; *sco.*, scolex. Koritska, 3, 4. After Grassi & Rovelli, 1892, Tav. IV, fig. 15.
Fig. 192. Anterior extremity of fig. 191. Koritska, 3, 8. After Grassi & Rovelli, 1892, fig. 16.
Fig. 193. Segments from Rudolphi's specimen of "*Tænia infundibuliformis*" in *Otis tarda.* After Krabbe, 1868, Tab. III, fig. 5. See text p. 44.

[Figs. 194–198. *Davainea proglottina.*]

Fig. 194. Adult worm: *g.*, ovary; *p.*, cirrus pouch; *r.*, receptaculum seminis; *t.*, testicle; *v.*, vagina; *vi.*, vitellogene gland. x95. After R. Blanchard, 1891B, fig. 4.
Fig. 195. Head of same with extended rostellum and one partly detached segment. After R. Blanchard, 1891B, fig. 5.
Fig. 196. Head with retracted rostellum; the first segment is forming from the neck. After R. Blanchard, 1891B, fig. 6.
Fig. 197*a–b*. Three isolated hooks: *a*, from rostellum; *b*, from suckers. After R. Blanchard, 1891B, fig. 7.
Fig. 198. Isolated egg. After R. Blanchard, 1891B, fig. 8.

PLATE XVI, FIGS. 199–211.—*Davainea proglottina* and *Davainea circumvallata.*

[Figs. 199–202. *Davainea proglottina.*]

Fig. 199. Cysticercoid, in which the oncospheric hooks are still visible: *ros.*, rostellum; *ven.*, suckers; Koritska 3, 8. After Grassi & Rovelli, 1892, Tav. IV, fig. 7. (Fresh specimen.)
Fig. 200. The same, preserved: *boc.*, opening of the cysticercoid; *cav.*, "cavity of the gastrula;" *lac.*, "primitive lacune;" *sco.*, scolex. Koritska, 3, 8. After Grassi & Rovelli, 1892, Tav. IV, fig. 8.

Fig. 201. Longitudinal section: *boc.*, opening of cysticercoid; *cav.*, "cavity of the gastrula;" *sco.*, scolex. Hartnack, 2, 7. After Grassi & Rovelli, 1892, Tav. IV, fig. 9.

Fig. 202. Young cysticercoid: *ven.*, sucker; *cod.*, tail. Koritska, 3, 5. After Grassi & Rovelli, 1892, Tav. IV, fig. 10.

[Figs. 203–211. *Davainea circumvallata.*]

Fig. 203. Ovum. x240. After Krabbe, 1869, Tab. X, fig. 295.

Fig. 204. Head and neck: *pr.*, rostellum; *r*, line of hooks; *v*, sucker; *c*, neck. After Crety, 1890, fig. 9.

Fig. 205. Hook from rostellum. After Crety, 1890, fig. 10.

Fig. 206. Ovum. After Crety, 1890, fig. 11.

Fig. 207. Frontal section of side of segment, through the cirrus pouch and vagina: *ci.*, cirrus; *va.*, vagina; *sg.*, genital sinus; *sb.*, cells of subcuticula. After Crety, 1890, fig. 12.

Fig. 208. Longitudinal section through egg sac: *m*, external capsule; *c*, granular content; *ov.*, ovum. After Crety, 1890, fig. 13.

Fig. 209. Scolex of "*T. pluriuncinata.*" x *ca.* 50. *a*, hook from rostellum; *b*, hook from sucker; *pr.*, rostellum; *v*, sucker; *s*, head; *c*, neck. After Crety, 1890, fig. 4.

Fig. 210. Ovum of same. After Crety, 1890, fig. 7.

Fig. 211. Frontal section of segment of same: *cl.*, ventral canal; *ct.*, transverse canal; *ur.*, egg sacs. After Crety, 1890, fig. 14.

PLATE XVII, FIGS. 212–227.—*Davainea cesticillus, Davainea echinobothrida,* and *Davainea tetragona.*

[Figs. 212–216. *Davainea cesticillus.*]

Fig. 212. Strobila. After Molin, 1861, Pl. VI, fig. 10.

Fig. 213. Anterior portion of same, and two posterior segments (middle portion of worm *ff*, omitted): *A*, head; *b*, ring surrounding the rostellum; *c*, rostellum; *d*, sucker; *E*, anterior portion of segmented body; *ff*, dotted line of omitted segments; *GG*, two posterior segments; *h*, extruded penis; *i*, vulva. After Molin, 1861, Pl. VI, fig. 11.

Fig. 214. Hook from rostellum of Dujardin's "*T. infundibuliformis* Gœze." x210. After Dujardin, 1845, Pl. IX, Fig. H, 2.

Fig. 215. Hook from rostellum. x920. After Krabbe, 1869, Tab. X, fig. 293.

Fig. 216. Ovum. x240. After Krabbe, 1869, Tab. X, fig. 294.

[Figs. 217–218. *Davainea echinobothrida.*]

Fig. 217. Strobila, natural size. After Mégnin, 1881A, Pl. V, fig. 1.

Fig. 218*a–d*. Head with appendages: *a*, head and neck; *b*, armature of suckers; *c*, hook from sucker; *d*, hook from rostellum. After Mégnin, 1881A, Pl V, fig. 2.

[Figs. 219–227. *Davainea tetragona.*]

Fig. 219. Head *D*, with rostellum (*a*) and suckers (*c*), followed by neck (*E*). Enlarged. After Molin, 1861, Tav. VII, fig. 6.

Fig. 220. Three posterior segments *A*, showing genital pores (*c*) and egg sacs (*b*). Enlarged. After Molin, 1861, Tav. VII, fig. 7.

Fig. 221. Isolated egg sac with (*a*) transparent membrane; *b*, granular substance; *c*, embryo in ovum (*d*). Enlarged. After Molin, 1861, Tab. VII, fig. 8.

Figs. 222–223. Head and neck showing armed rostellum and armed suckers. x35. After Krabbe, 1882, Tab. II, figs. 55, 56. From material collected by Fedtschenko in Turkestan.

Fig. 224. Hook from rostellum of same. x920. After Krabbe, 1882, Tab. II, fig. 59.

Fig. 225. A segment showing two longitudinal canals, several testicles, vas deferens, cirrus pouch and genital pore. x35. After Krabbe, 1882, Tab. II, fig. 57.

Fig. 226. Posterior segment, showing genital pore and egg sacs. x35. After Krabbe, 1882, Tab. II, fig. 58.

Fig. 227. Female genital organs: *vg.*, vagina; *r s.*, receptaculum seminis; *bd. trsv.*, transverse collecting canal; *cl. ov.*, opening of the ovarian tubules; *c. s.*, seminal canal; *ovd. disc.*, descending oviduct; *glv.*, vitellogene gland; *vt. ld.*, vitello-duct; *ovd. asc.*, ascending oviduct; *sb. ovd.*, opening of the ascending oviduct; *sbc. vtld.*, opening of the vitello-duct; *ootp.*, ootyp with shell gland. After Diamare, 1893, fig. 4.

PLATE XVIII, Figs. 228–246.—*Davainea tetragona, Davainea Friedbergeri* and *Davainea crassula.*

[Figs. 228–235. *Davainea tetragona.*]

Figs. 228–229. Supposed larvæ of "*Tænia bothrioplitis*" (=*Davainea tetragona*) from a snail (*Helix*). Treated with acetic acid. After Piana, 1882, Figs. F, 8, A., and F, 8, B., reduced.

Fig. 230. Piece of the intestine of a fowl showing the nodules (reduced one-third). After Moore, 1895, fig. 1*a*.

Fig. 231. The mucosa of the intestine showing ulcerated areas; also several small and one larger tapeworm attached to the intestine (reduced one-third). After Moore, 1895, fig. 1*b*.

Fig. 232. A cross section of the intestine illustrating the thickening of the wall, due to a large number of the nodules; also a portion of a tapeworm which has penetrated the mucous membrane (enlarged). After Moore, 1895, fig. 1*c*.

Fig. 233. A cross section of a nodule containing a sequestrum situated in the outer or longitudinal muscular layer (circular layer of the muscular wall not affected). After Moore, 1895, fig. 2*a*.

Fig. 234. A section showing a tapeworm and a necrotic mass within the muscular wall. After Moore, 1895, fig. 2*b*.

Fig. 235. A portion of a cross section of the intestine showing the head of a tapeworm within the muscle and one lying between the villi with its head resting on the basement membrane of the mucosa. Enlarged. After Moore, 1895, fig. 2c.

[Figs. 236–242. *Davainea Friedbergeri.*]

Fig. 236. Hook from rostellum. After Friedberger, 1877, fig. 1.

Fig. 237. Hooks from the suckers. After Friedberger, 1877, fig. 2.

Fig. 238. Hook of oncosphere. After Friedberger, 1877, fig. 3.

Fig. 239. "*T. infundibuliformis* var. *phasiarum*," seu "*T. agama*"=? *Davainea Friedbergeri.* Natural size. After Mégnin, 1878, Pl. IV, fig. 1.

Fig. 240. View of head of same, *en face*, showing armed rostellum and 4 armed suckers. x120. After Mégnin, 1878, Pl. IV, fig. 3.

Fig. 241. Hook from rostellum of same. x725. After Mégnin, 1878, Pl. IV, fig. 4.

Fig. 242. Segments of same species. x20. After Mégnin, 1878, Pl. IV, fig. 4.

[Figs. 243–246. *Davainea crassula.*]

Fig. 243. "Eggs" (=Egg sacs) magnified. After Rudolphi, 1819, Tab. III, fig. 19.

Fig. 244. Hook from rostellum. x920. After Krabbe, 1869, Tab. X, fig. 301. From Rudolphi's original specimens.

Fig. 245. Anterior end of worm, showing rostellum and two suckers. x35. After Krabbe, 1882, Tab. II, fig. 66. From material collected in Turkestan by Fedtschenko.

Fig. 246. Hook from rostellum of same. x920. After Krabbe, 1869, Tab. II, fig. 67.

PLATE XIX, FIGS. 247–255.—*Echinocotyle Rosseteri* and *Ophryocotyle proteus*.

[Figs. 247–251. *Echinocotyle Rosseteri*.]

Fig. 247. Strobila. x120. After R. Blanchard, 1891B, fig. 1.
Fig. 248, Head with extended rostellum. x500. After R. Blanchard, 1891B, fig. 2.
Fig. 249*a–b*. Hooks: *a*, from rostellum, x400; *b*, from sucker, x2,500. After R. Blanchard, 1891B, fig. 3.
Fig. 250. Isolated segment: 1, evaginated cirrus with spines; 2, genital tubercle; 3, orifice of same with sphincter; 4, cirrus pouch, with ring of minute sharp spines; 5, seminal canal; 6, mass of spermatozoa. x600. After Rosseter, 1892, Pl. XXIII, fig. 8.
Fig. 251. Cysticercoid taken from the body cavity of *Cypris cinerea; a*, hooks on rostellum; *b*, hooks on suckers. x360. After Rosseter, 1892, Pl. XXII, fig. 1.

Figs. 252–255. *Ophryocotyle proteus*. After Friis, 1869, taken from R. Blanchard, 1891B, fig. 20.

Fig. 252. Strobila.
Fig. 253. Head and neck with retracted infundibulum.
Fig. 254. Head and neck with extended infundibulum.
Fig. 255. Sucker with armature.

PLATE XX, FIGS. 256–269.—*Tænia cantaniana, Tænia Delafondi, Tænia imbutiformis, Tænia megalops*, and *Tænia nigropunctata*.

Fig. 256. *Tænia cantaniana: a*, head; *b*, suckers; *c*, organ taken by Polonio for the "genital pore?"; *d*, well-developed eggs. After Polonio, 1860, Tav. VII, fig. 2.

[Figs. 257–262.—Mégnin's (1891, Figs. A–F.) figures of "*Tænia sphenocephala*" = Railliet's *Tænia Delafondi*.]

Fig. 257. Strobila natural size.
Fig. 258. Head and neck. x60.
Fig. 259. Three sexually active segments. x14.
Fig. 260. Egg. x375.
Fig. 261. Isolated oncosphere.
Fig. 262. Segmenting egg.

Fig. 263. *Tænia imbutiformis: a*, suckers; *b*., middle portion; *c*, caudal portion; *d*, "genital pores" (?). After Polonio, 1860, Tav. VII, fig. 3.

[Fig. 264–267.—*Tænia megalops* from Brazilian teal (*Anas braziliensis*). Coll. Vienna Museum.]

Fig. 264. Strobila natural size. Original.
Figs. 265–267. Three views of head, enlarged. Original.

[Figs. 268–270. *Tænia nigropunctata*. After Crety, 1890.]

Fig. 268. Head: *v*, sucker; *c*, neck. After Crety, 1890, fig. 3.
Fig. 269. Isolated segment: *l*, eggs; *m*, ovary; *p*, genital pore; *u*, uterus. After Crety, 1890, fig. 1.
Fig. 270. Egg with oncosphere. After Crety, 1890, fig. 2.

PLATE XXI, FIGS. 271–274.—*Tænia malleus, Idiogenes otidis* and *Tænia sp.* Conard, MS.

Fig. 271. *Tænia malleus*, head and anterior segments. After Goeze, 1782, Tab. XXX, fig. 3.

[Figs. 272–274. *Idiogenes otidis.*]

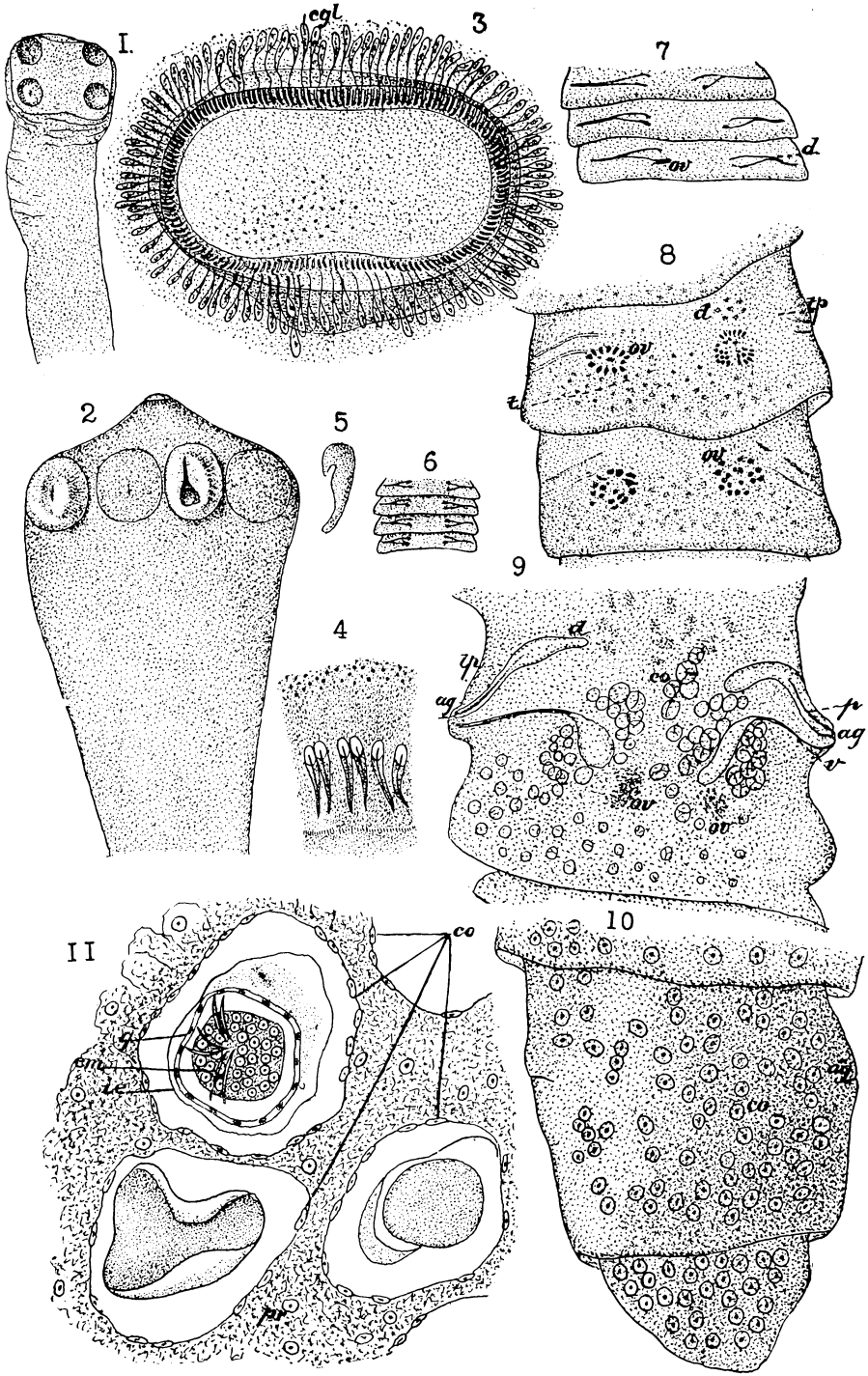
Fig. 272. Pseudoscolex and anterior portion of strobila. The first four segments form the pseudoscolex. After Zschokke, 1888, Pl. III, fig. 39.

Fig. 273. Segment with male and female organs: *cd.*, vas deferens; *c. e.*, vas efferens; *ci.*, cirrus; *t.*, testicles; *f. d. v.*, end of vagina (receptaculum seminis); *gl. g.*, ovary; *gl. v.*, vitellogene gland; *va.*, vagina. After Zschokke, 1888, Pl. III, fig. 42.

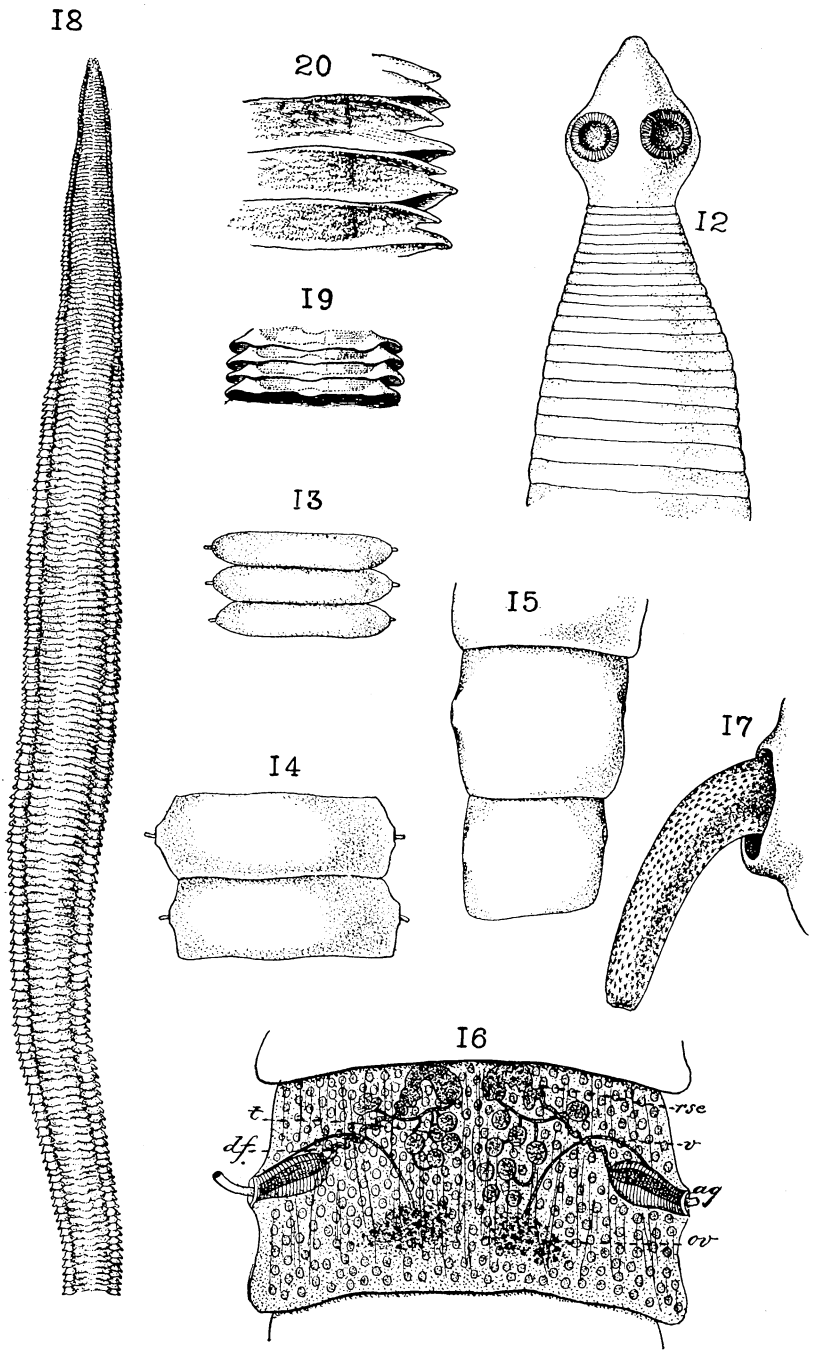
Fig. 274. Segment with developed uterus: *cap. ut.*, superior uterine cavity; *c. d.*, vas deferens; *p. d. c.*, cirrus pouch; *va.*, vagina. After Zschokke, 1888, Pl. III fig. 46.

[Figs. 275, 276. Two diagrams of *Tænia* sp. from chickens. After Conard, unpublished.]

Fig. 275. Dorsal view; fig. 276, transverse section: *n.*, nerve; *d. c.*, dorsal canal; *v. c.*, ventral canal; *t. c.*, transverse canal; *g. c.*, genital cloaca with pore; *c.*, cirrus; *c. p.*, cirrus pouch; *v. s.*, vesicula seminalis; *t.*, testicle; *ut.*, "probably uterus" (or testicle?); *v.*, vagina; *r. s.*, receptaculum seminis; *ov.*, probably ovary; *s. g.*, probably shell gland; *l. m.*, longitudinal muscles.

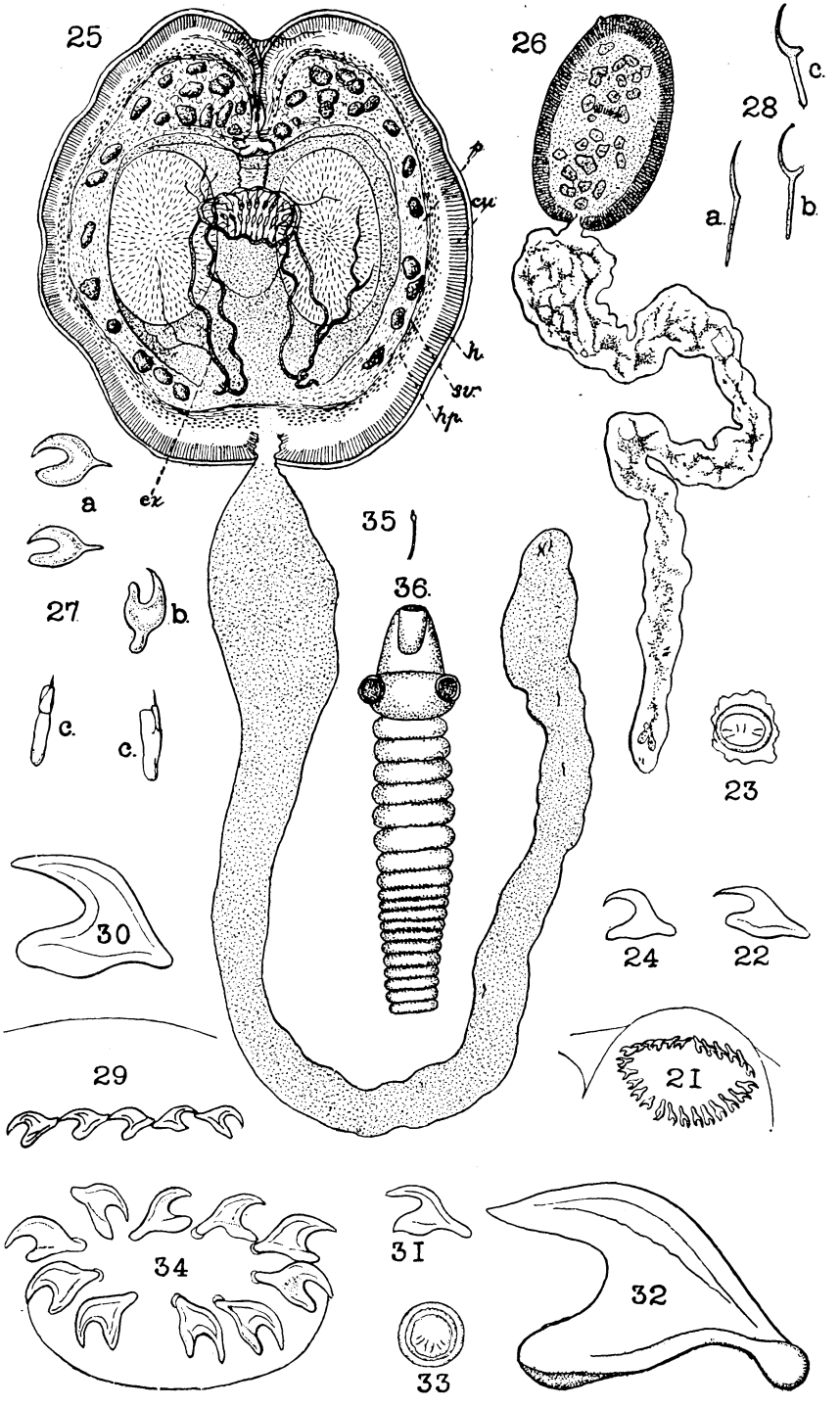


1-11. *Cotugnia digonopora.*

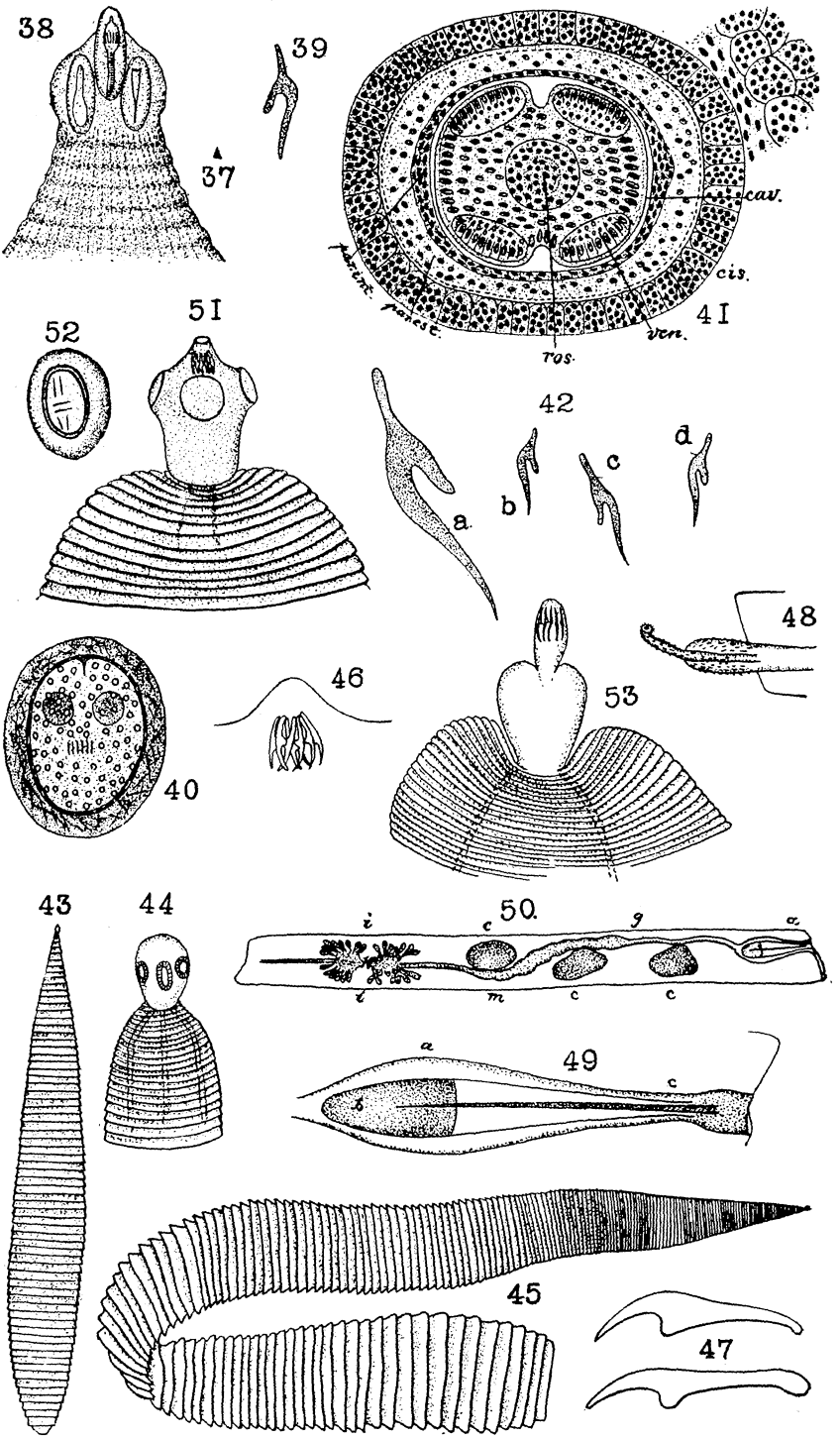


12–17. *Cotugnia bifaria.*

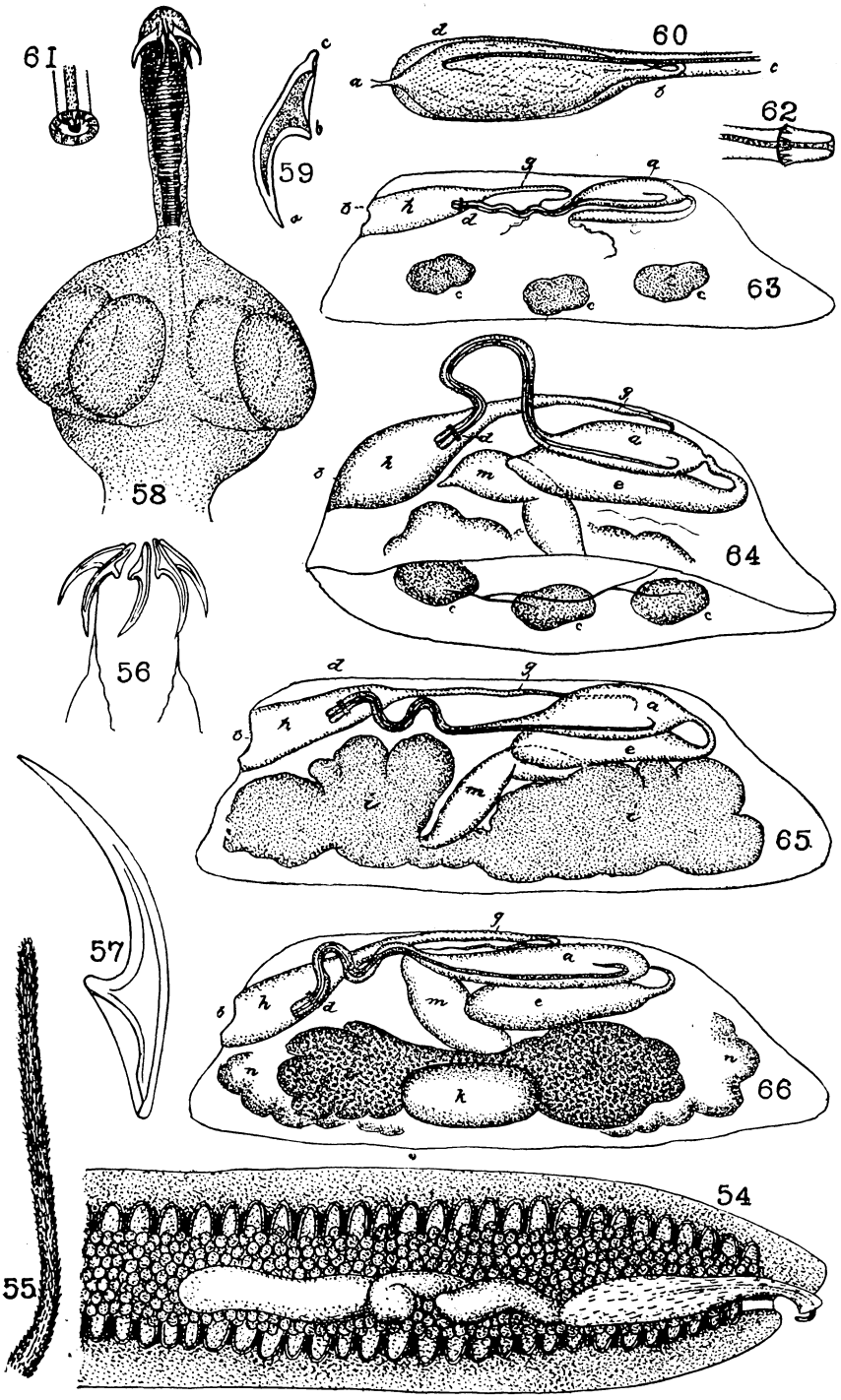
18–20. *Amabilia lamelligera.*



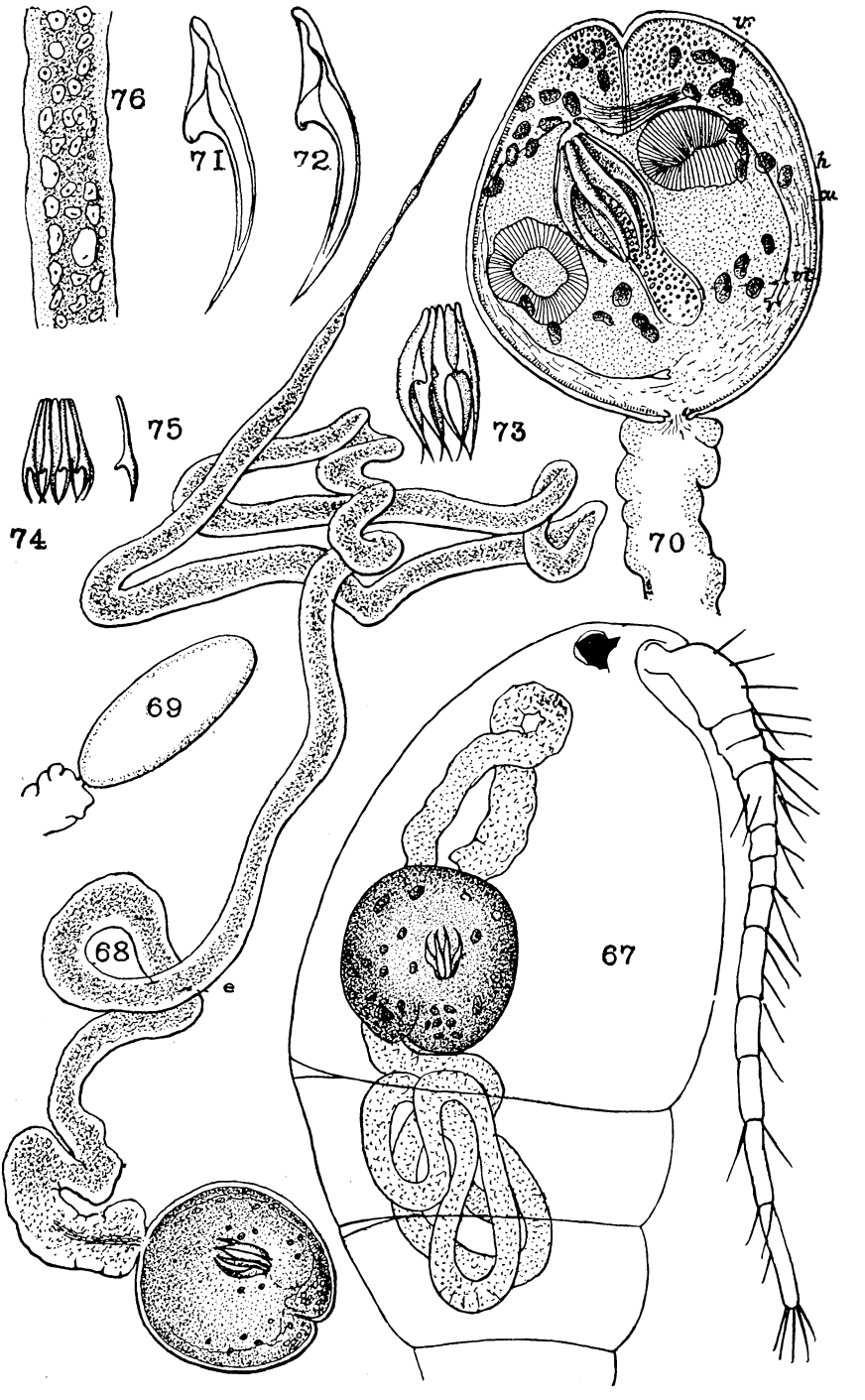
21–28. *Dicranotænia coronula.*
29–30. *Dicranotænia æquabilis.*
31–34. *Dicranotænia furcigera.*
35–36. *Tænia conica.*



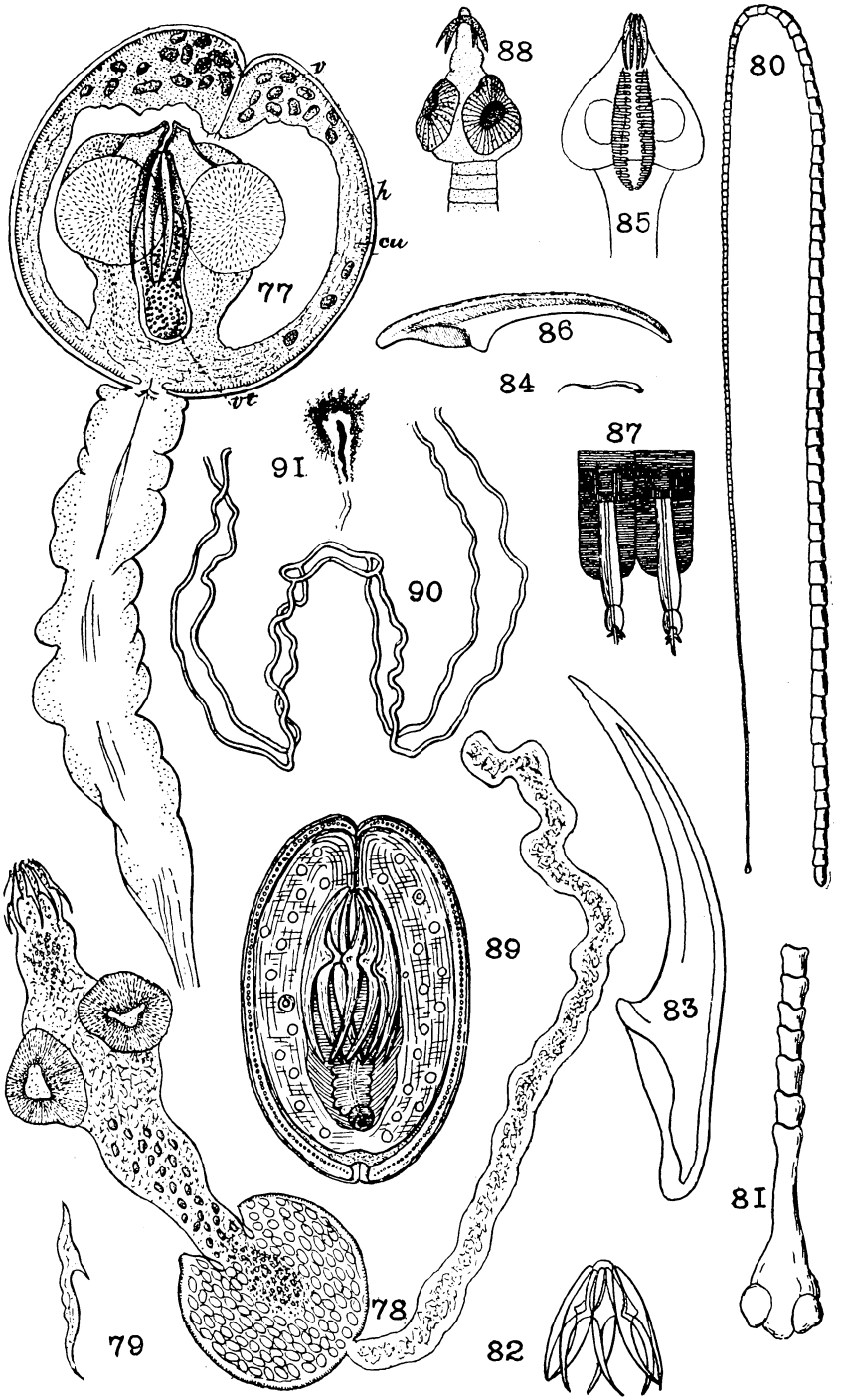
37-42. *Dicranotœnia sphenoides.* 43-53. *Drepanidotœnia lanceolata.*



54-55. *Drepanidotœnia lanceolata.* 56-66. *Drepanidotœnia fasciata.*

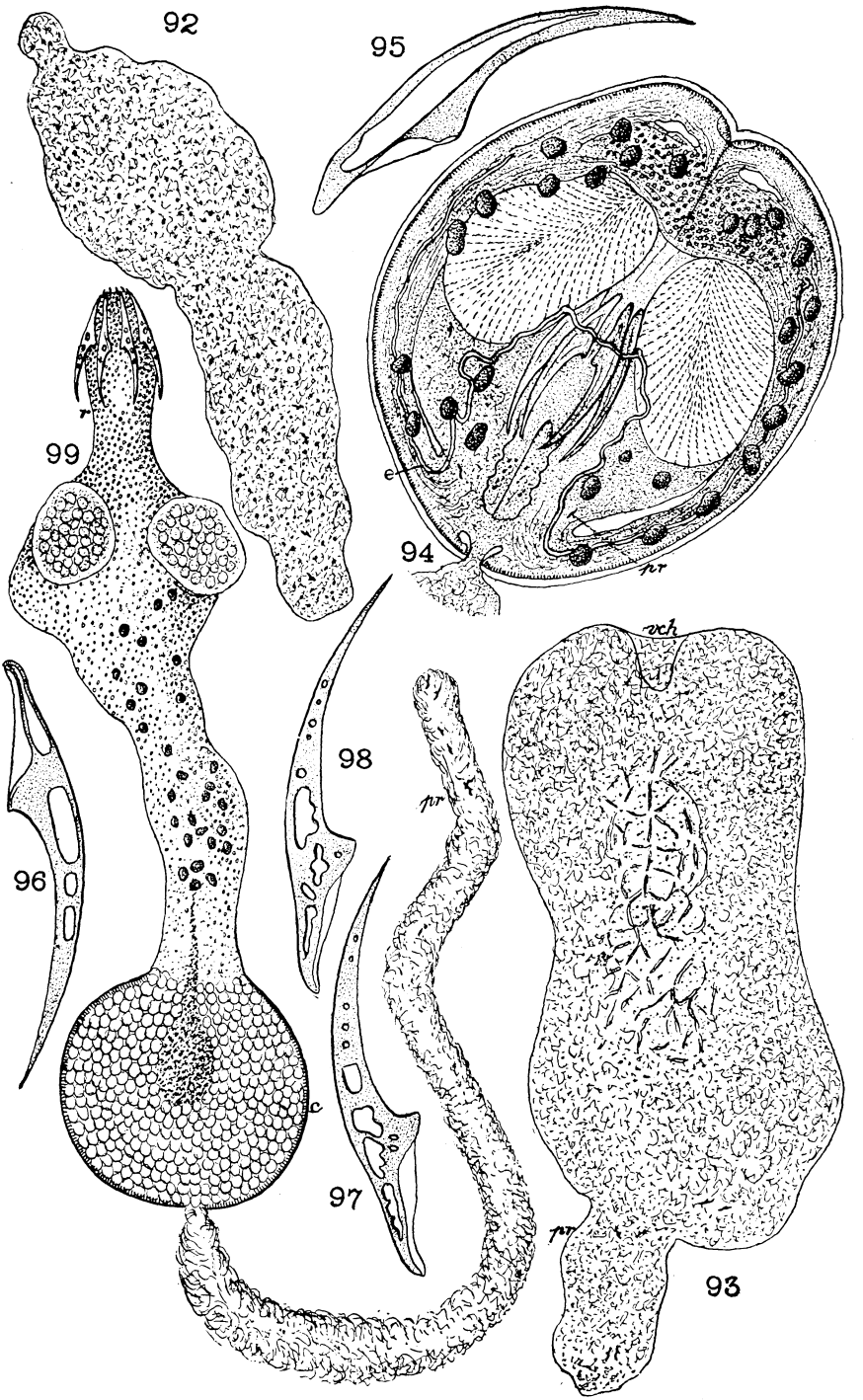


67–76. *Drepanidotœnia fasciata.*

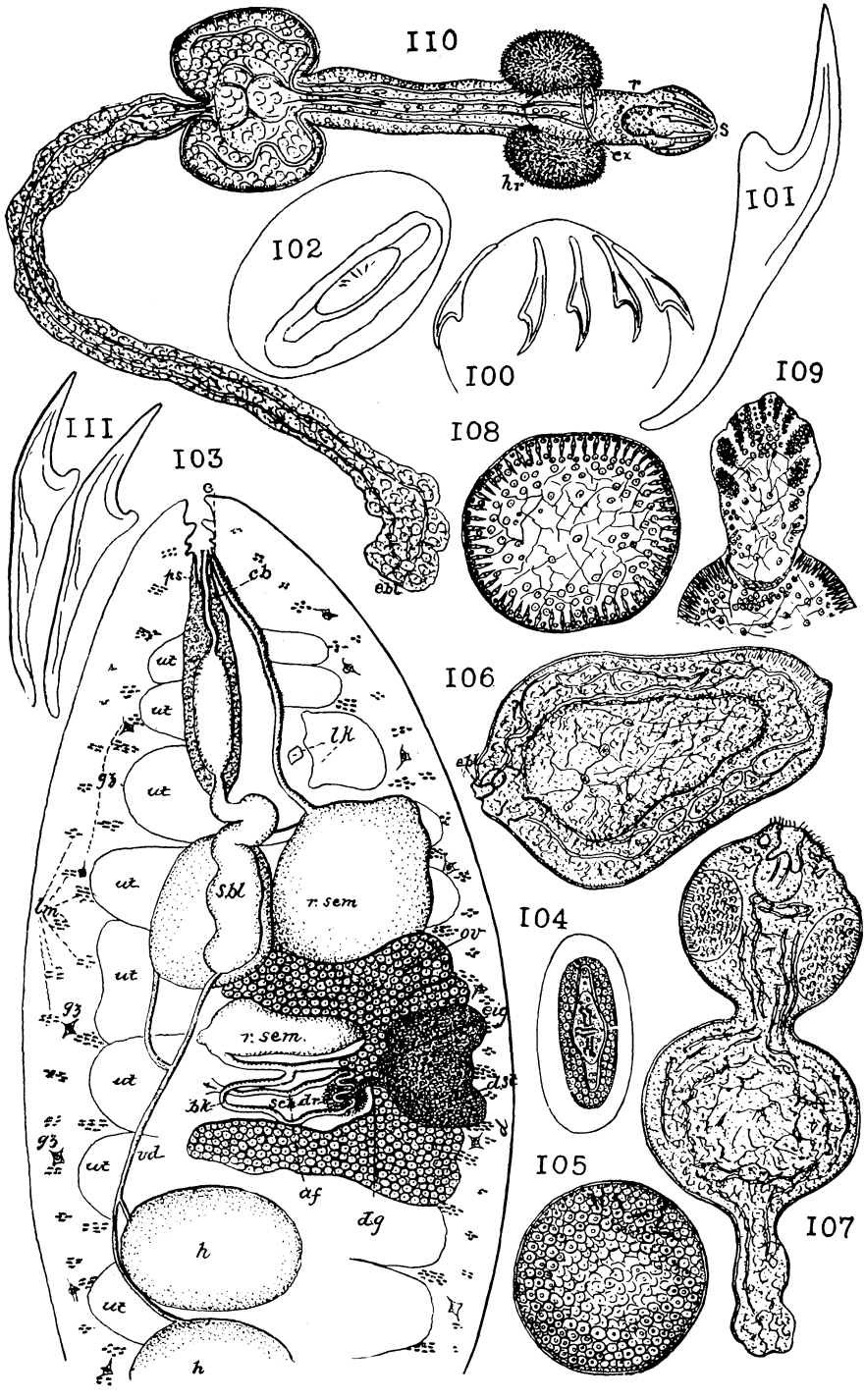


77-79. *Drepanidotœnia fasciata.*

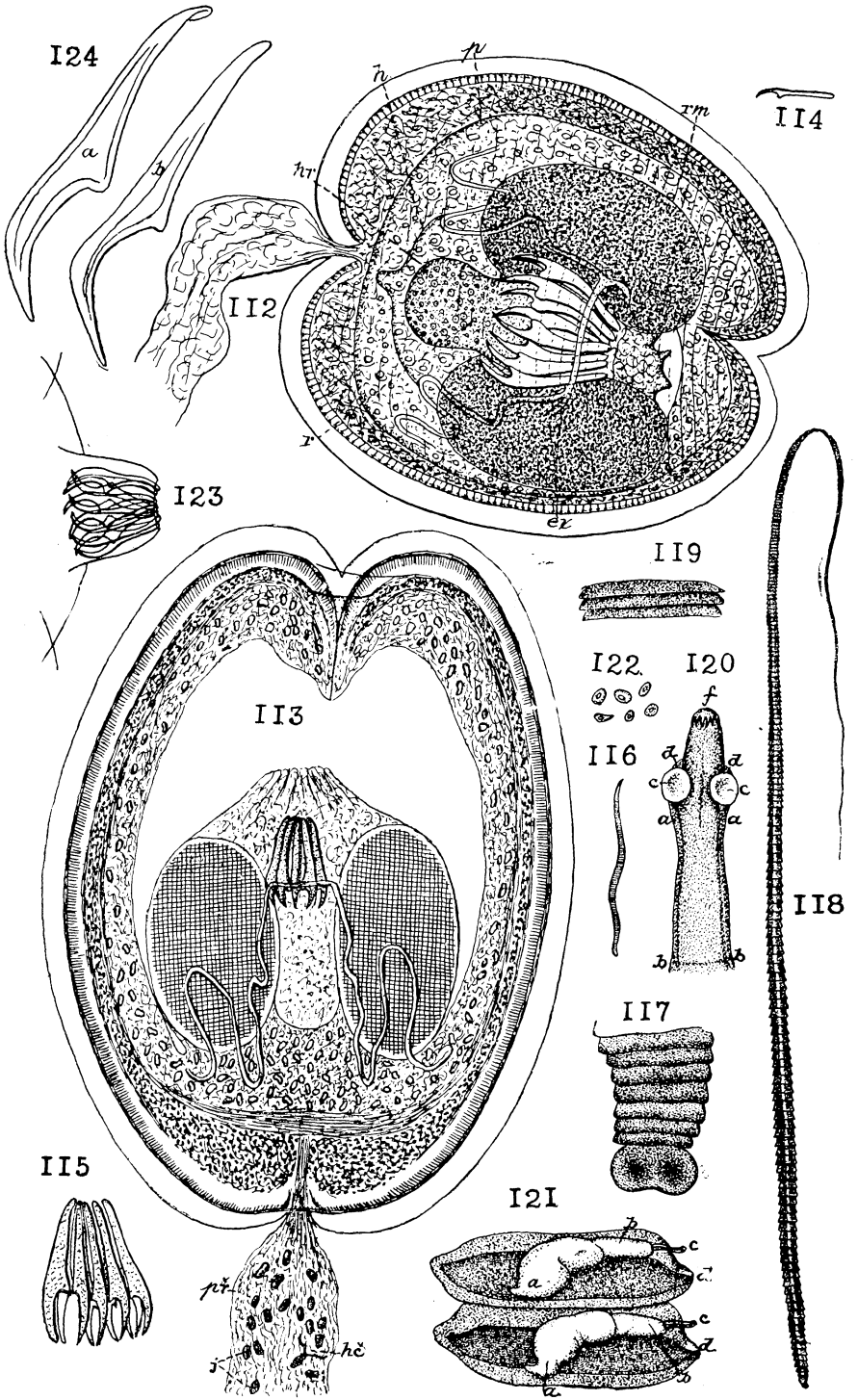
80-91. *Drepanidotœnia gracilis.*



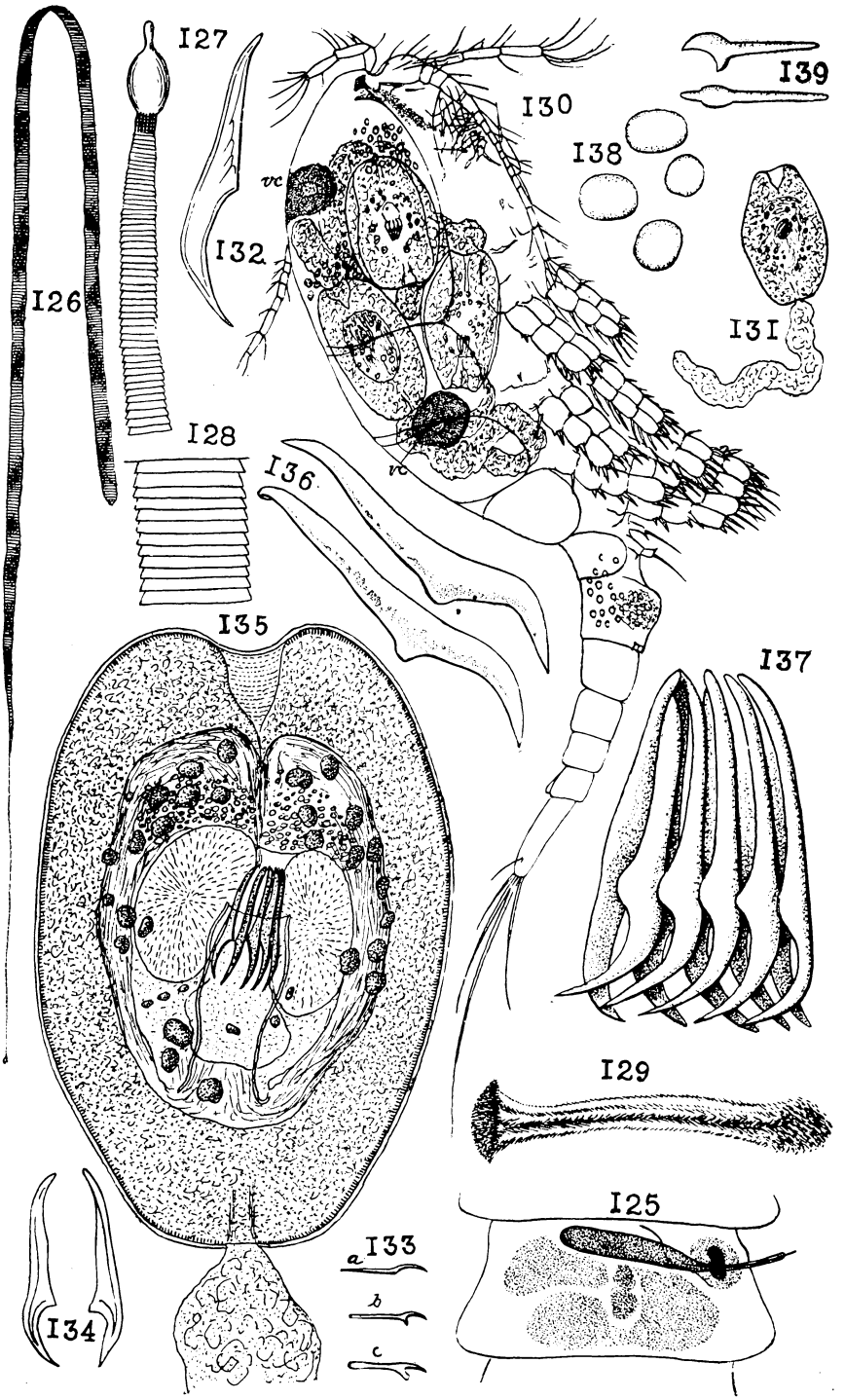
92-99. *Drepanidotænia gracilis.*



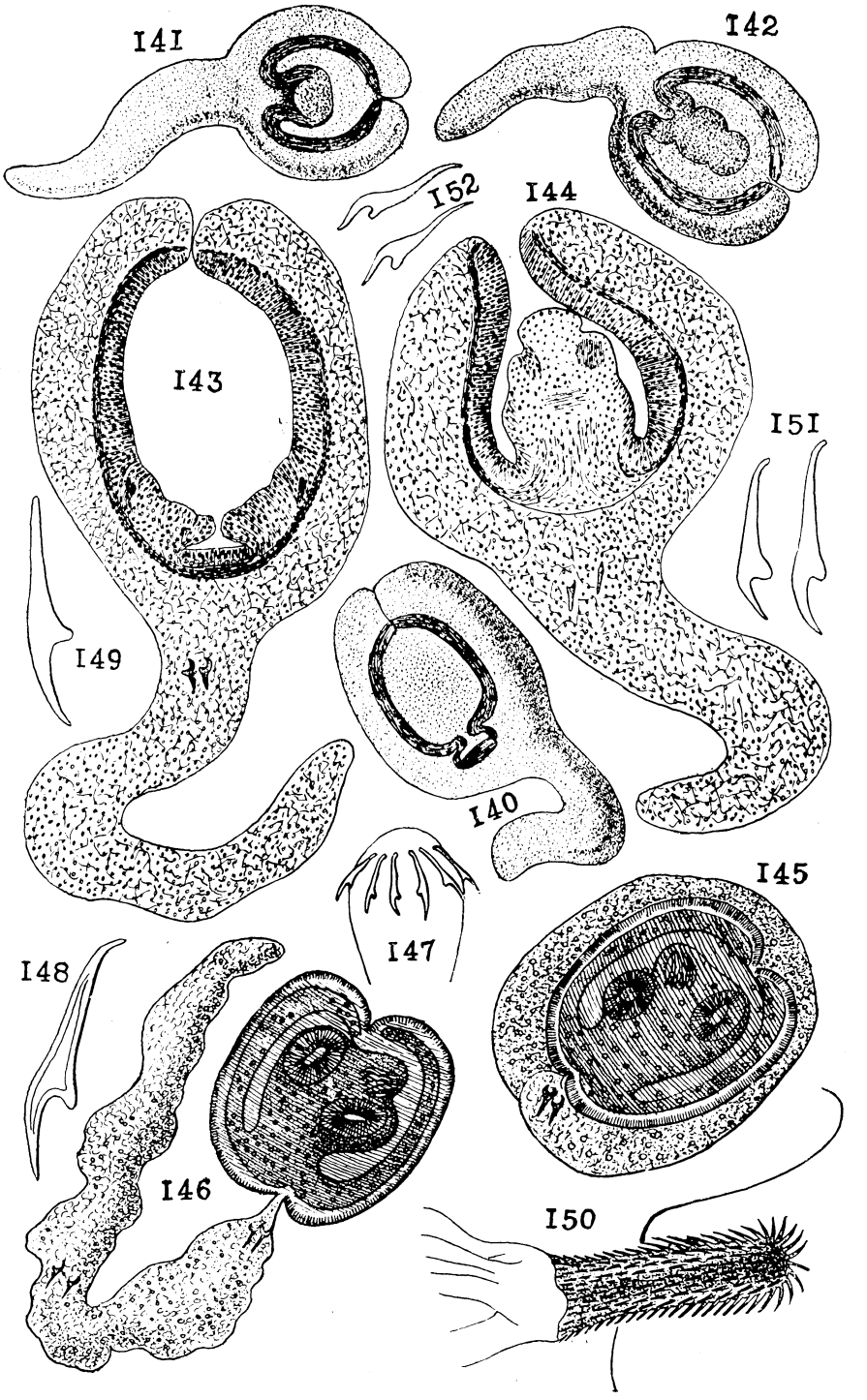
100–111. *Drepanidotœnia anatina.*



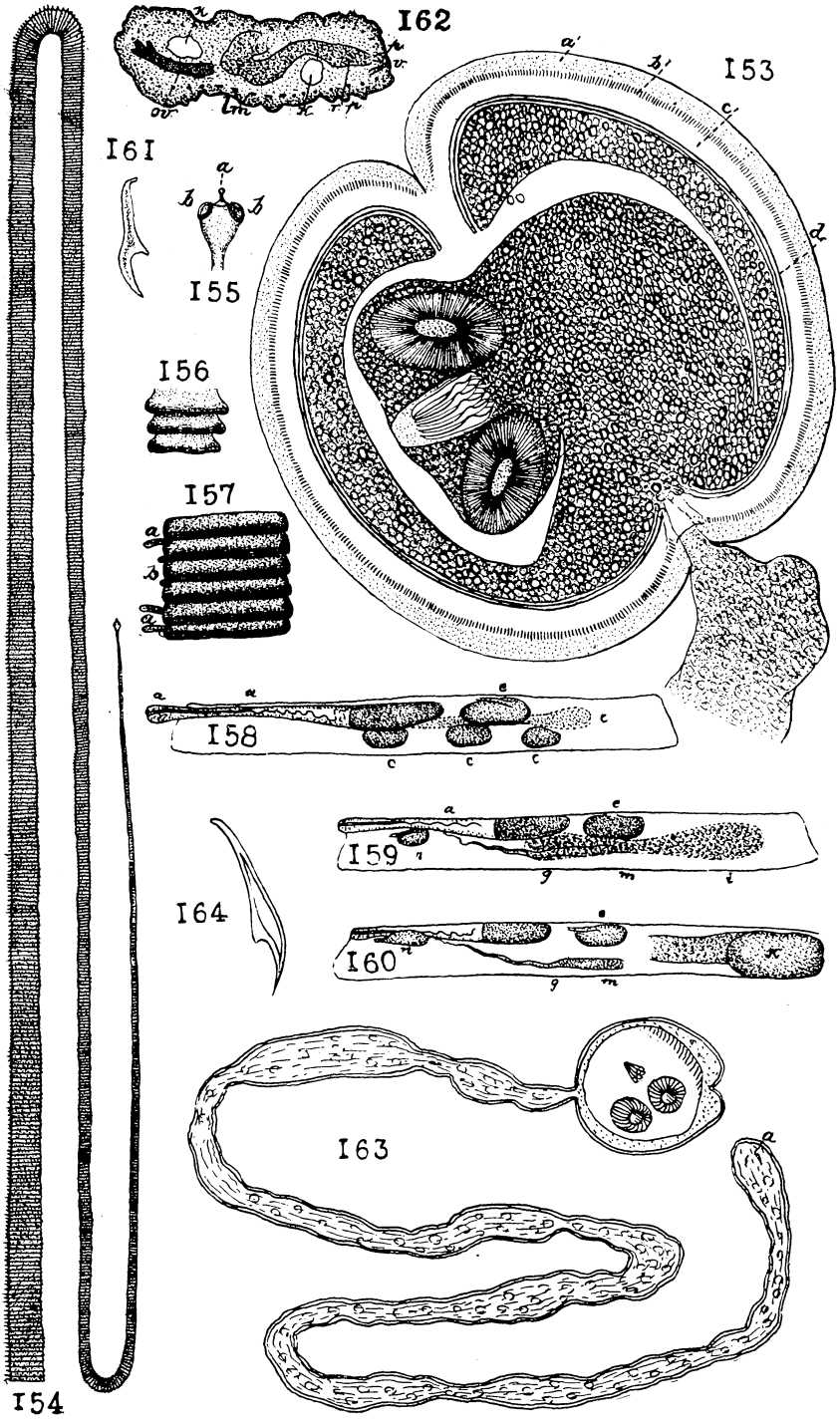
112–115. *Drepanidotœnia anatina.* 116–124. *Drepanidotœnia sinuosa.*



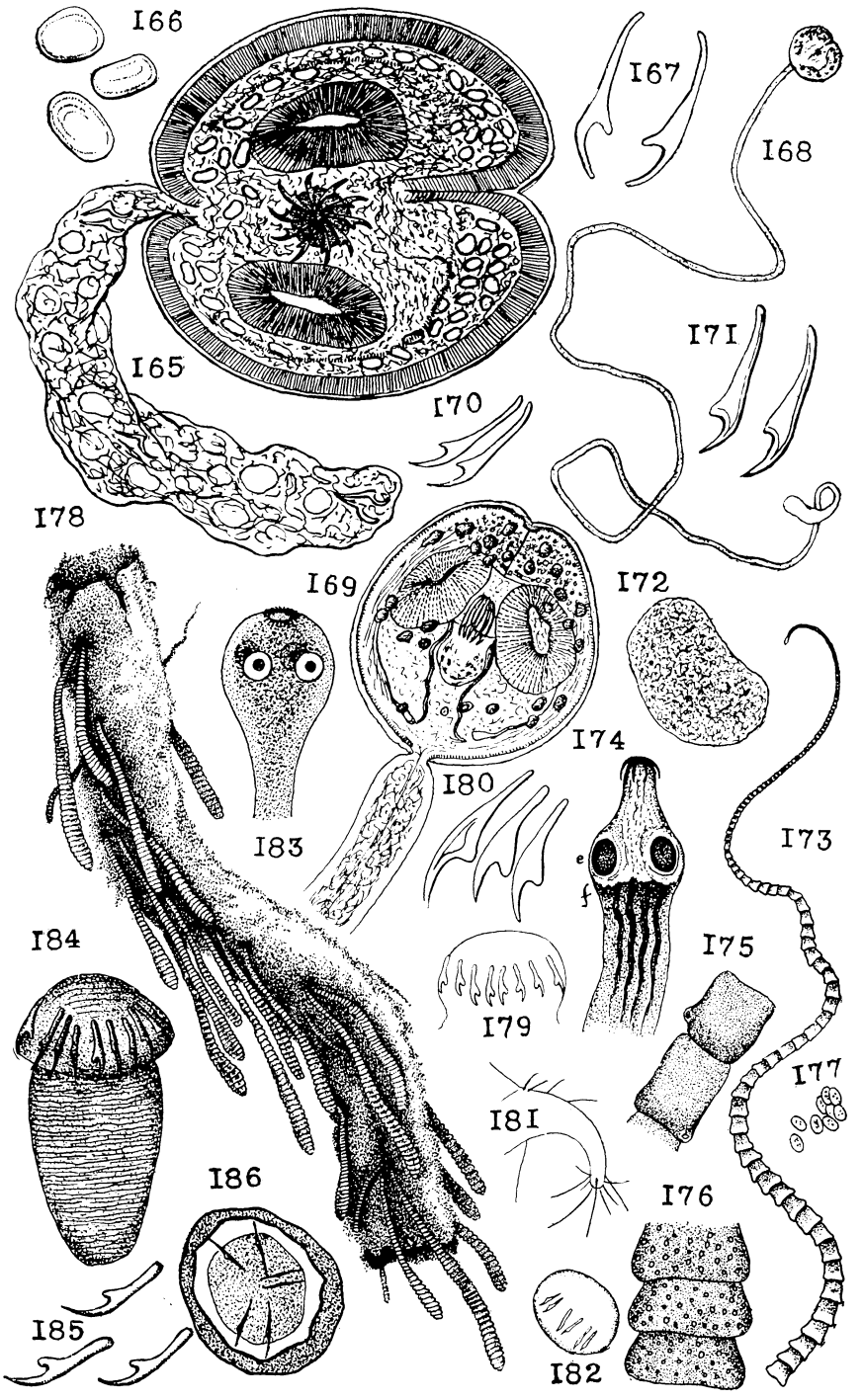
125–139. *Drepanidotœnia sinuosa.*



140–146. *Drepanidotænia sinuosa.* 147–150. *Drepanidotænia setigera.*
151–152. *Tænia Krabbei* Kowalewski.

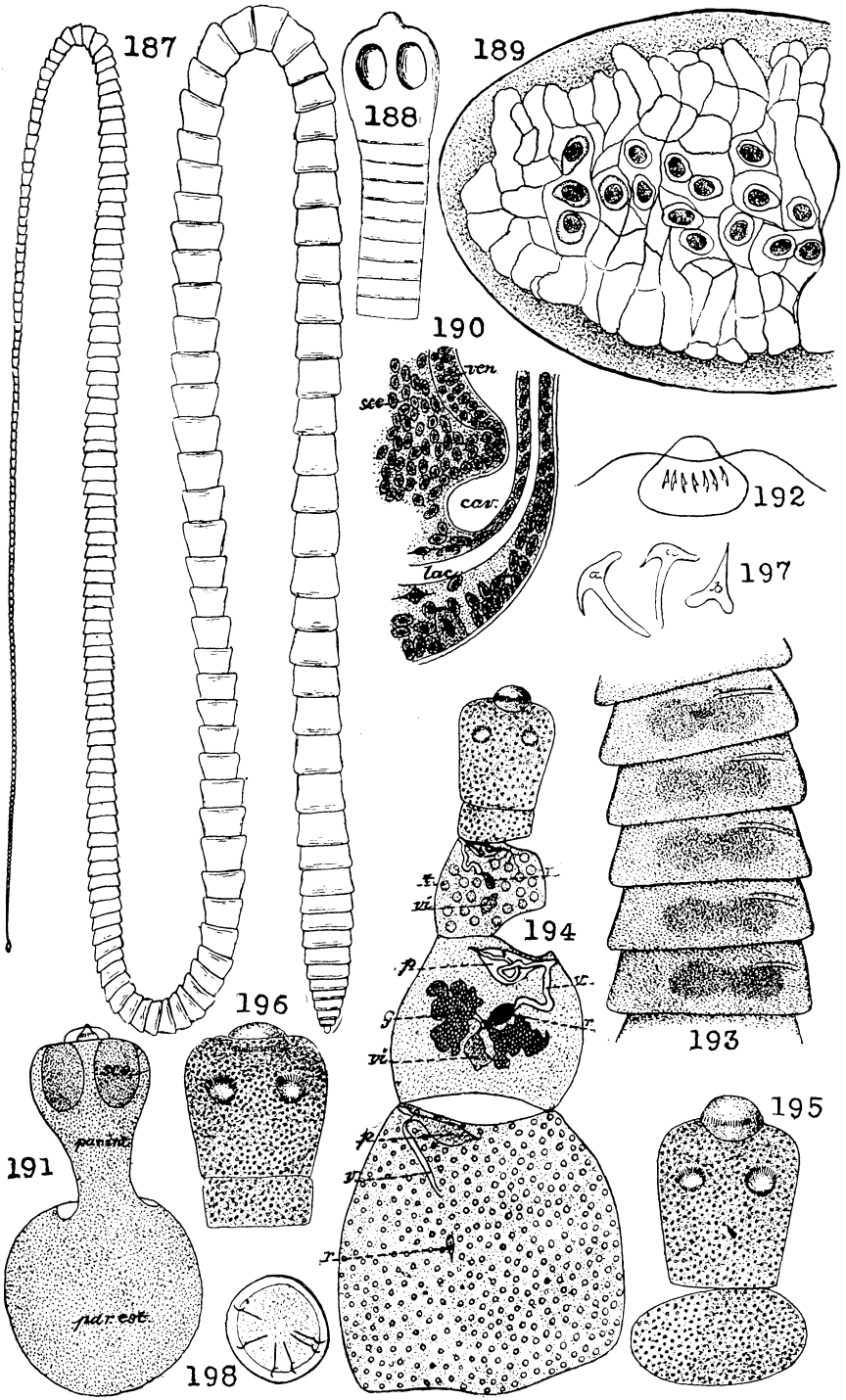


153. *Drepanidotænia sinuosa.* 154–164. *Drepanidotænia setigera.*

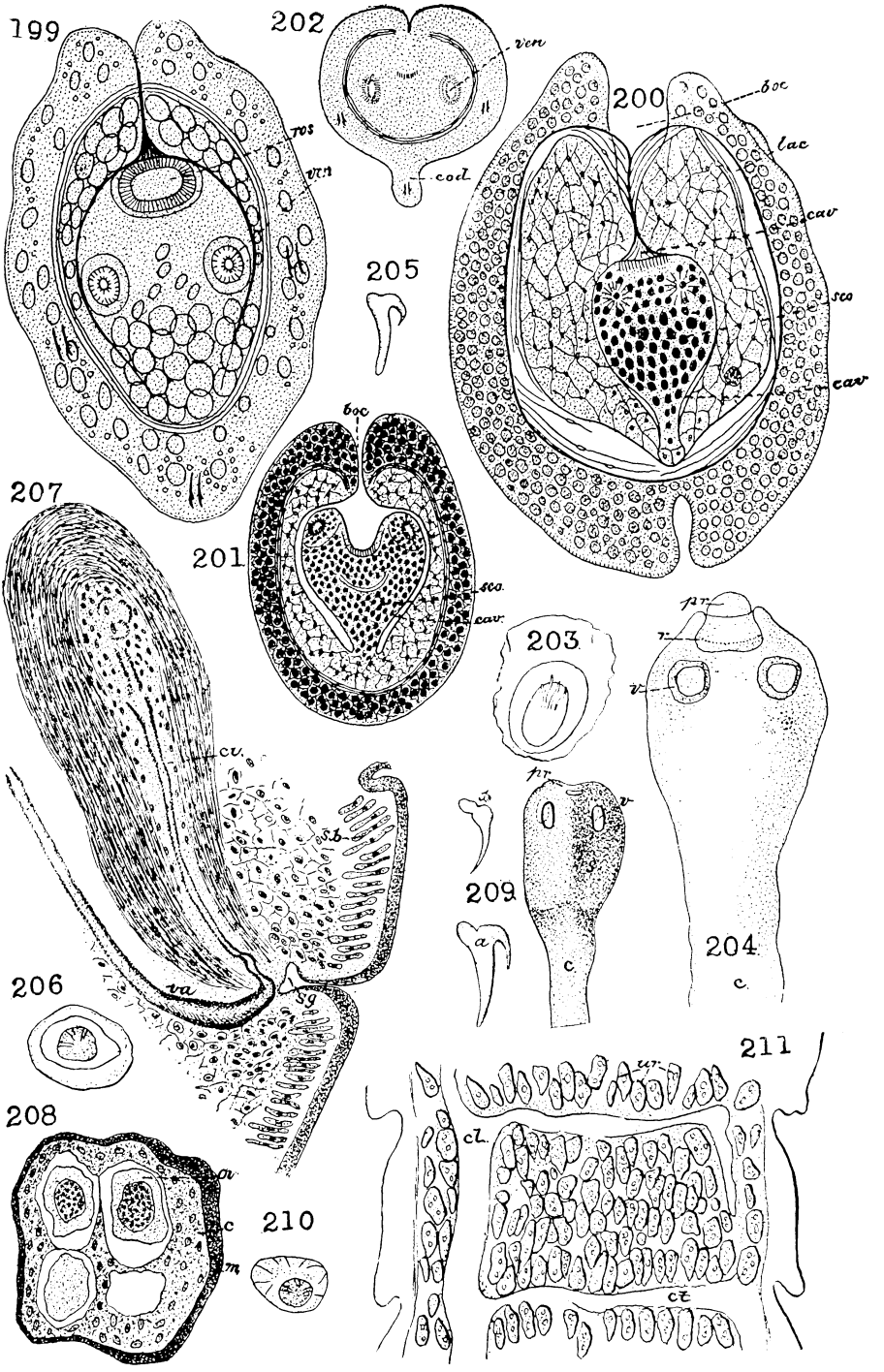


165–172. *Drepanidotœnia tenuirostris.*

173–186. *Drepanidotœnia infundibuliformis.*

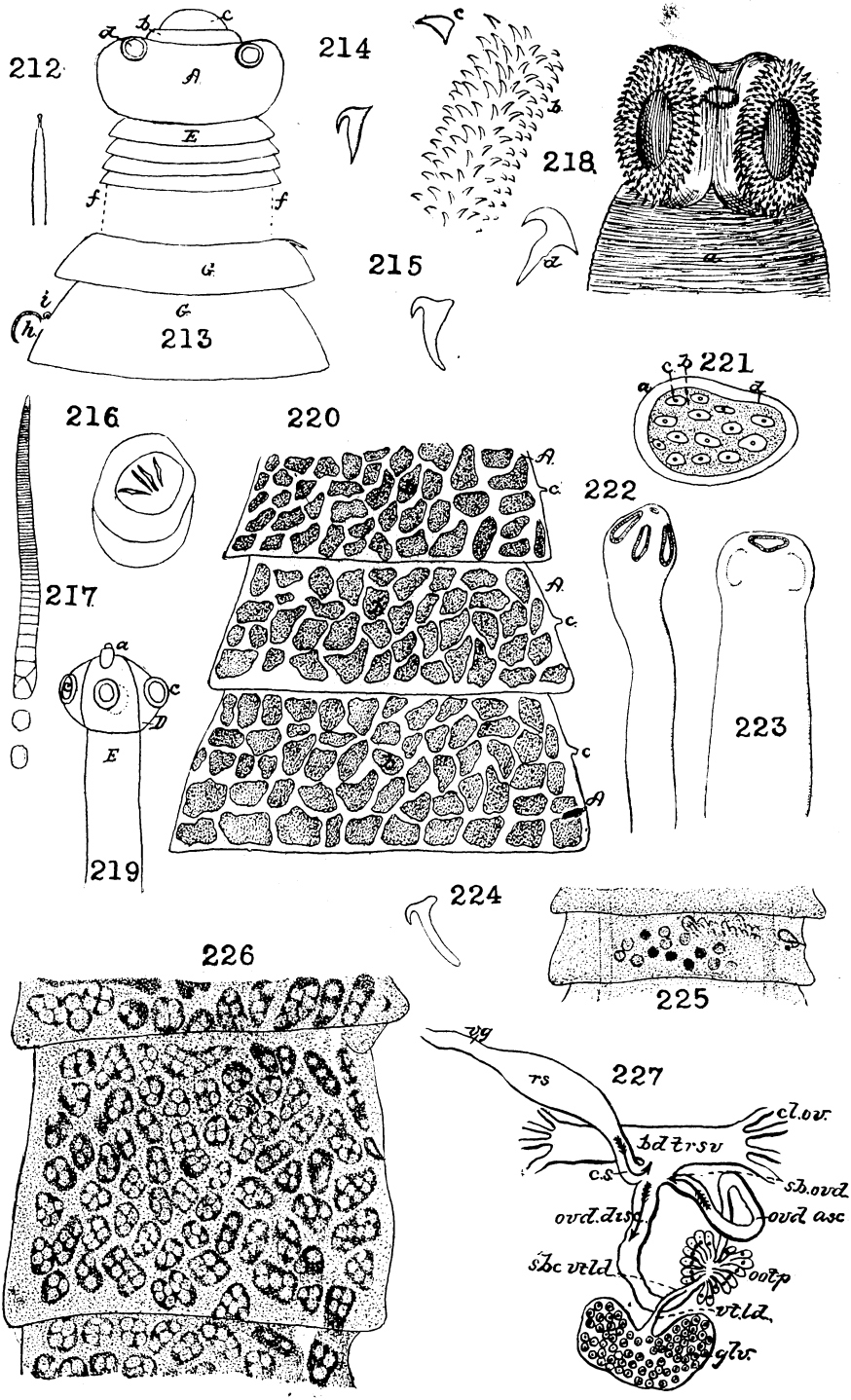


187–193. *Drepanidotœnia infundibuliformis.* 194–198. *Davainea proglottina.*

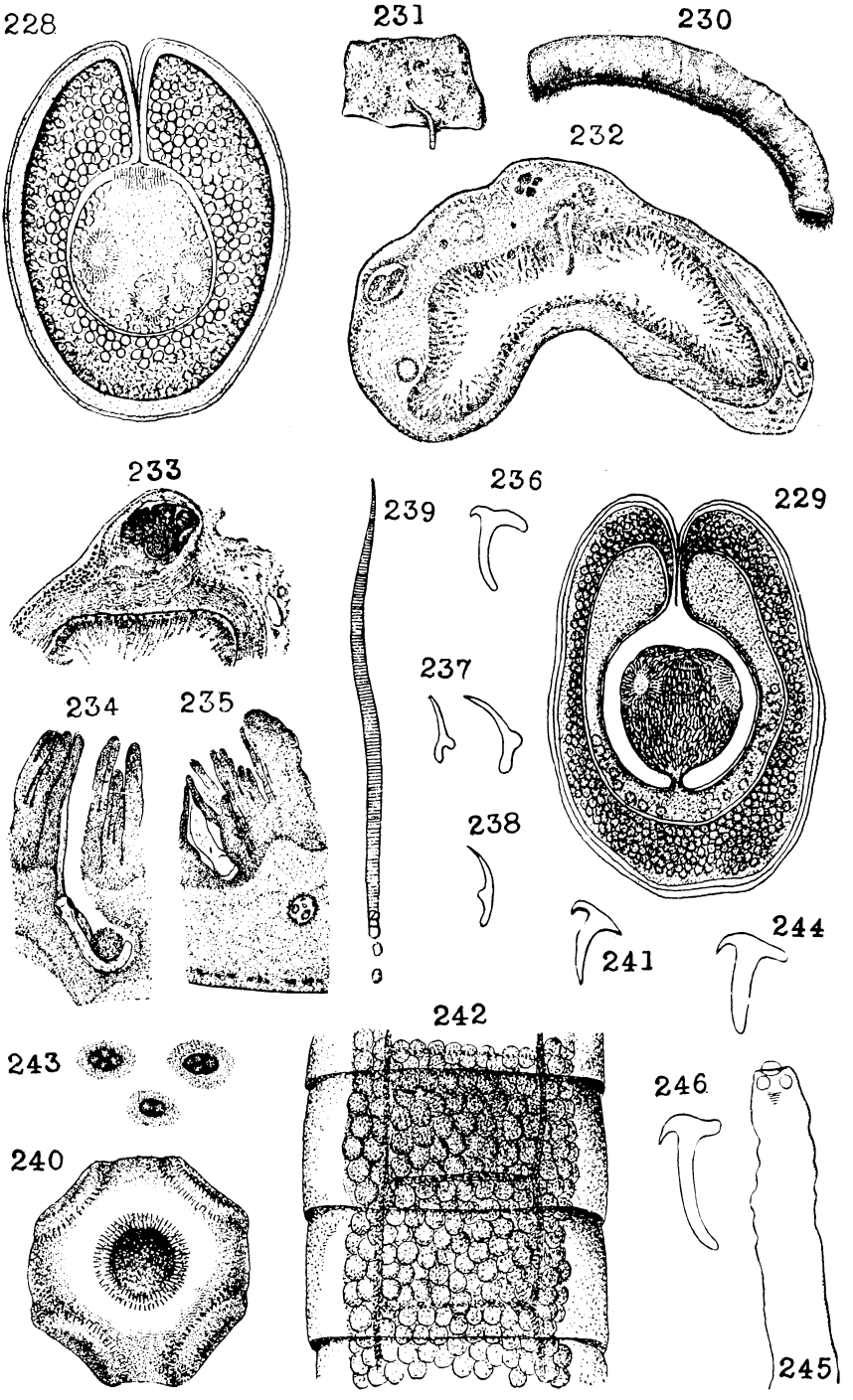


199–202. *Davainea proglottina.*

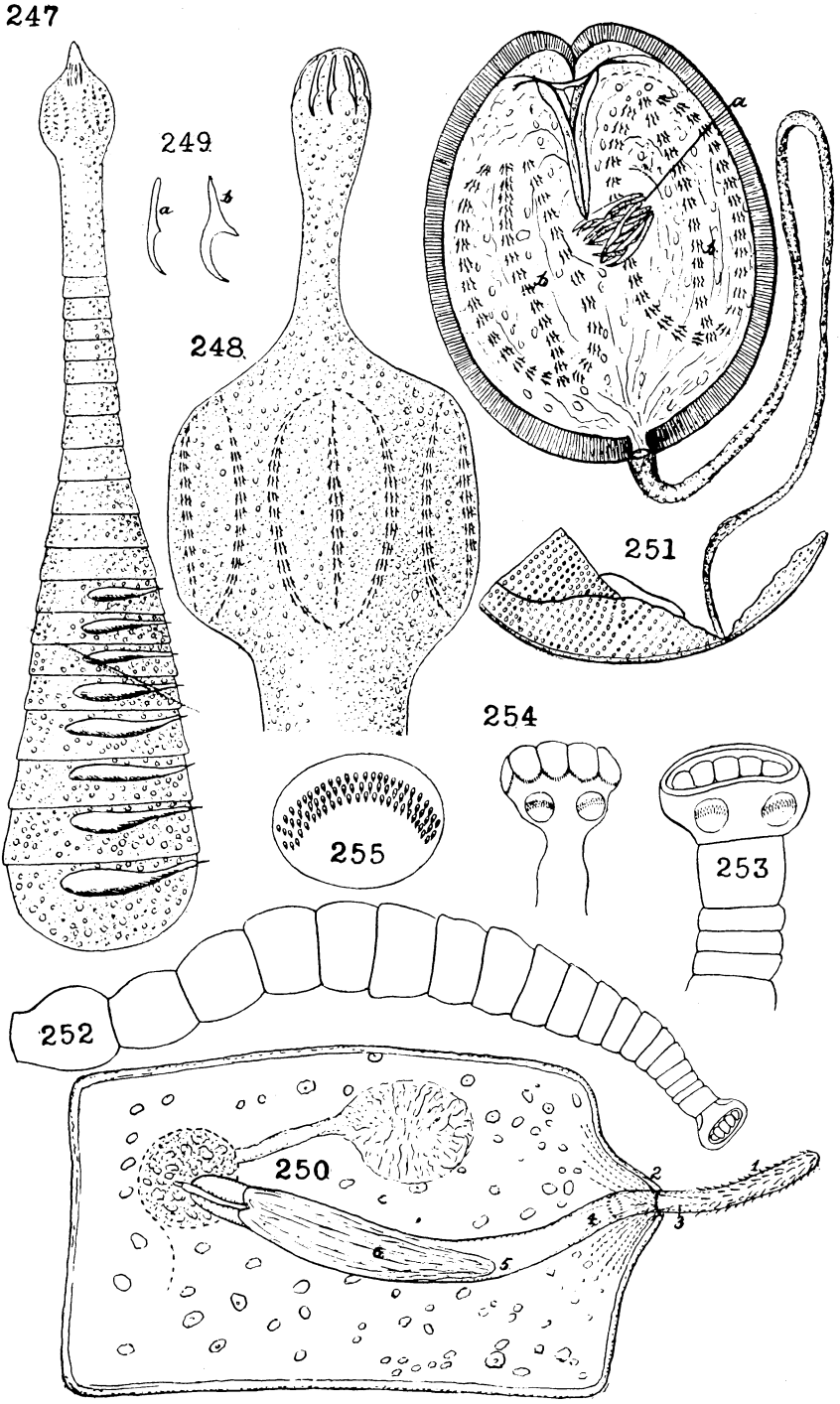
203–211. *Davainea circumvallata.*



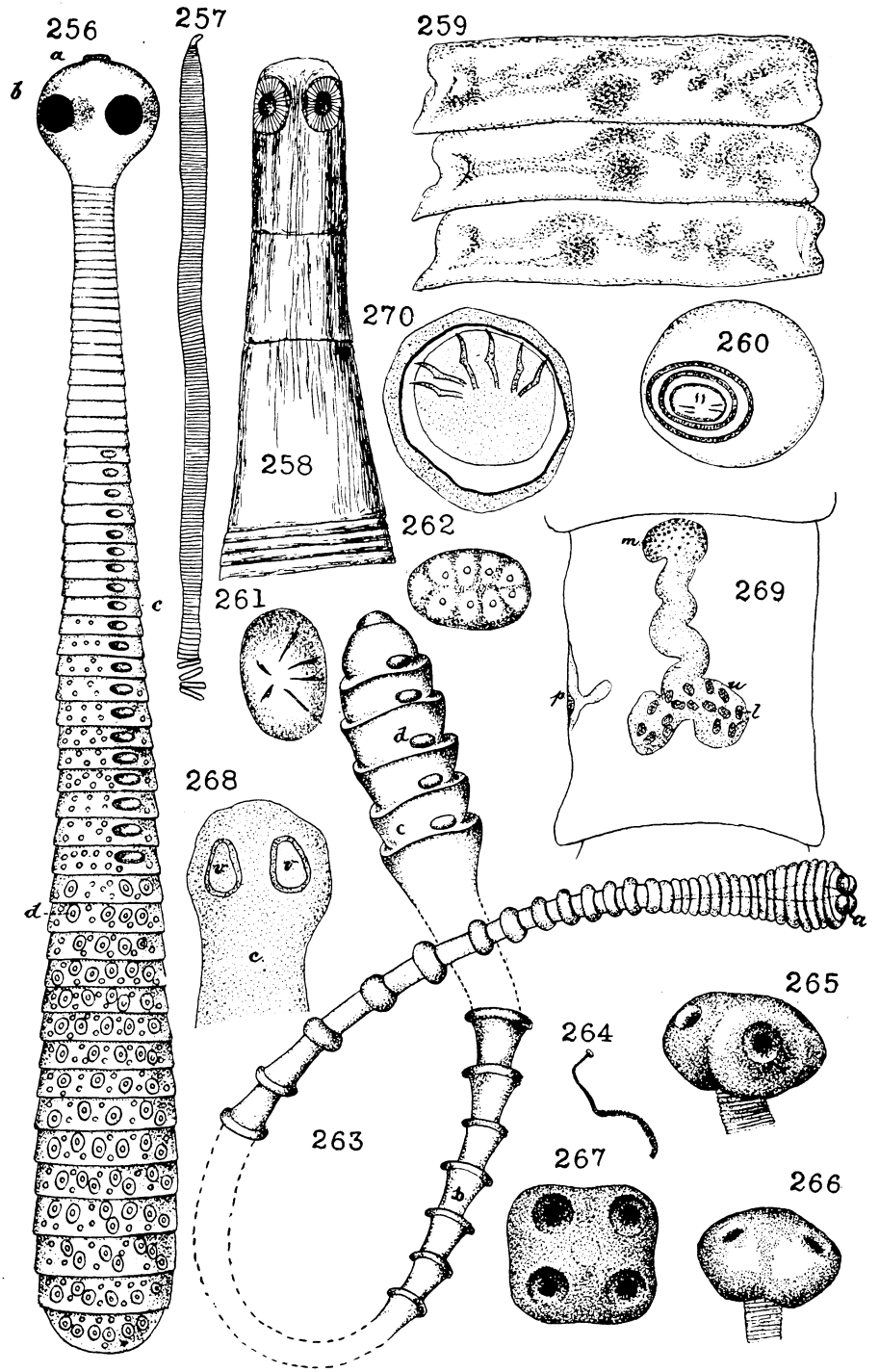
212-216. *Davainea cesticillus.* 217-218. *Davainea echinobothrida.*
219-227. *Davainea tetragona.*



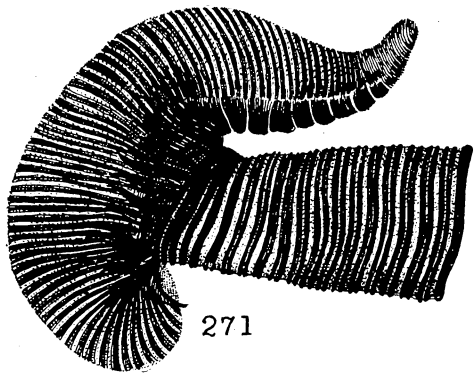
228-235. *Davainea tetragona.* 236-242. *Davainea Friedbergeri.* 243-246. *Davainea crassula*

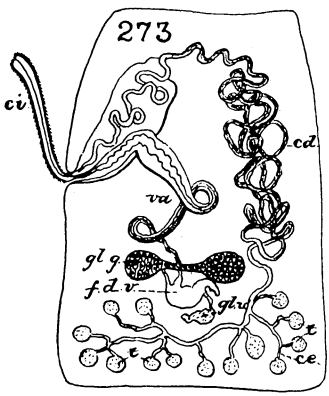


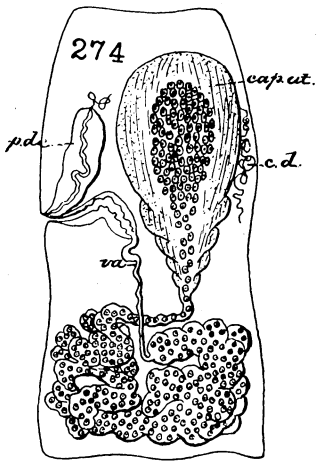
247-251. *Echinocotyle Rosseteri.* 252-255. *Ophryocotyle proteus.*

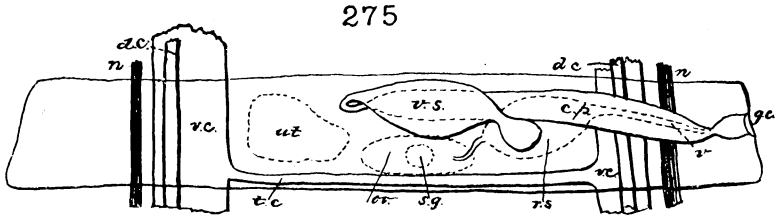


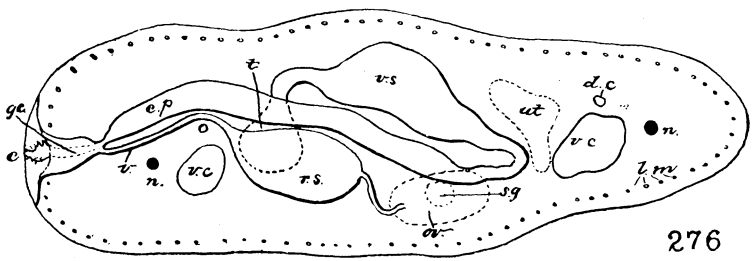
256. *Tænia cantaniana.* 257–262. *Tænia Delafondi.* 263. *Tænia imbutiformis.*
264–267. *Tænia megalops.* 268–270. *Tænia nigropunctata.*











271. *Fimbriaria malleus.* 272–274. *Idiogenes otidis.* 275–276. *Tænia* sp. of Conard.

INDEX TO SCIENTIFIC NAMES.

[Parasites are given in italics; hosts are given in roman. Heavy-faced figures (**24**, **31**, etc.) refer to the more important references; c refers to chart of parasites at end of text.]

Page.

Aix sponsa c
Allobophora fœtida 10, 12, 35
Alyselminthus
columbæ 53, 54
crenatus 37
infundibuliformis 43
setigerus 41
sinuosus 40, 41
Amabilia ..... 23, **24**, 29, **31**, c
lamelligera ..... **31**, c
Anas
acuta (see Dafila acuta) 41
boschas ..... 33, 34, 38, 39, 40, 44, 53, 55, c
boschas domestica. 33, 37, 38, 39, 40, 44, 55, 59, c
boschas fera (see Anas boschas) 35
braziliensis ..... 40, 59, c
circia (see Anas querquedula) 34
crecca ..... 59, c
cygnoides (see Cygnopsis cygnoides).
fera (see Anas boschas).
fuligula (see Aythya fuligula).
fusca 41
glacialis (see Clangula hyemalis).
leucocephala (see Erismatura leucocephala).
leucophthalma (see Aythya leucophthalma).
leucophthalmos (see Aythya leucophthalma).
obscura ..... 37, c
olor (see Olor cygnus) 34
penelope ..... 34, 38, c
querquedula c
strepera c
superciliosa c
Anatidæ c
Anoplocephala 28
Anoplocephalinæ 24, 28
Anser
albifrons ..... 38, 42, c
anser ..... 38, 40, 58, c
domesticus ..... 37, 38, 40, 42, 43, 58, c
cinereus (see Anser anser).
domesticus (see Anser anser domesticus).
fabalis ..... 42, c
segetum (see Anser fabalis).
Anseres c
Arctonetta Fischeri c
Ardea gazetta 54

Aythya — Page.
americana c
australis ..... 30, 31, c
cristata (see Aythya fuligula) 40, 59
ferina ..... 29, 34, 37, c
fuligula c
marila ..... 34, 43, 59, c
nyroca ..... 29, 30, 37, 59, c
rufina ..... 37, c
Bernicla leucopsis (see Branta leucopsis).
Biziura lobata c
Bonasa umbellus c
Bothriocephalidæ ..... 10, **23**, **25**, 28, c
Bothriocephalinæ **23**, **25**
Bothriocephalus **24**, **25**
claviceps 26
cordatus 25
cristatus 25
dendriticus ..... 26, c
ditremus ..... 26, c
fissiceps 26
latus 25
liguloides 25
longicollis 26
Mansoni 25
podicepes 26
sp 10, 26
Bothriotœnia 23, **24**, **26**
longicollis ..... 10, 25, **26**, c
Branta
canadensis c
leucopsis ..... 42, c
Caccabis
petrosa c
saxatilis ..... 54, c
Cairina moschata ..... 37, c
Calidris arenaria 56
Callipepla squamata c
Camptolaimus labradorius c
Candona 12
candida 10, 12, 33
rostrata 10, 12, 38, 39
Carpophaga oceanica ..... 54, c
Centrocercus urophasianus ..... 54, c
Cercocystis Drepanidotœniæ fasciatæ **36**
gracilis **38**
setigeræ **42**
sinuosæ **40**
tenuirostris **43**
Chapmania **45**, **46**
Charadrias hiaticula **56**

Page.

Charitonetta albeola c
Chenopis atrata c
Chen hyperborea c
Choanotœnia 61
infundibuliformis 61
Clangula hyemalis c
Cœnurus 24
Colinus virginianus c
Columba
arquatrix c
fasciata c
livia ..... 53, c
domestica ..... 44, 45, 53, 57, c
talpacota (see Columbigallina talpacoti).
Columbigallina
passerina terrestris c
talpacoti c
Conurus carolinensis c
Copepoda 12
Corvus
cornix 32
corone 32
frugilegus 32
monedula 32
Cotugnia 23, 24, 28, **29**, 30
bifaria ..... **30**, 31, c
digonopora ..... 10, 29, **30**, c
Coturnix
communis (see Coturnix coturnix).
coturnix ..... 44, 48, 59, c
dactylisonans ..... 48, c
Cryptocystis 32
Cyclops 12
agilis 10, 12, 13, 38, 40, **41**, 43
brevicaudatus 10, 12, 42
lucidulus 10, 13, 40, 41
pulchellus 10, 13, 43
sp 12
viridis 10, 13, 38, 39, 40, 41
Cygnopis
canadensis (see Branta canadensis).
cygnoides c
Cygnus
atratus (see Chenopis atrata).
ferus 40
gibbus c
musicus (see Olor cygnus).
olor (see Olor cygnus).
olor domesticus (see Olor cygnus domesticus).
Cypria ophthalmica 10, 12, 33, 38, 39, 40
Cypridæ 55
Cyprinidæ 27
Cypris 12
cinerea 10, 12, 33, 55
compressa 10, 12, 33, 38, 39, 40
incongruens 10, 12, 39, 40
ovata 10, 12, 39, 40
ovum 10, 12, 33
Cyrtonyx montezumæ c
Cysticæ 28
Cysticercus 24
bovis 28
tenuicollis 28
Cystoideæ 28
Cystoidotœniæ 28, 61

Page.

Cystotœniæ 28
Dafila acuta ..... 34, 39, 40, 41, 59, c
Daphnia 12
Davainea 23, **25**, 27, 28, **45**, 57, 60
australis ..... 54, c
calva c
cesticillus ..... 10, 44, **46**, **48**, c
circumcincta 54
circumvallata ..... **46**, **47**, 48, c
columbæ 53
contorta 55
crassula ..... 10, **46**, **53**, c
echinobothrida ..... 10, **46**, **49**, 50, c
Friedbergeri ..... **46**, **52**, c
frontina 54
insignis ..... 54, c
leptosoma ..... 54, c
madagascariensis 55
proglottina ..... 10, 11, 12, 17, **46**, **47**, 57, c
retractilis 55
Salmoni 55
struthionis ..... 10, 54, c
tetragona ..... 10, 12, **15**, **46**, **49**, 50, c
urogalli ..... 54, c
Dendragapus obscurus c
Dendrocygna fulva c
Dibothrium 25
ligula 27
longicolle 27
Dibothrius 25
Dicranotœnia 23, **24**, 28, 32
æquabilis ..... 10, 32, 33, c
coronula ..... 10, 12, **32**, **33**, 55, c
cuneata 35, 61
furcigera ..... 10, **32**, **34**, c
sphenoides ..... 10, 12, **32**, **35**, 61, c
Dilepis 22
Diplacanthus 31, 32
Diplogonoporus 24
Dipylidiinæ **24**, 28, 29, 61
Dipylidium **24**, 28, **29**, 30, 31
caninum 29
Drepanidotœnia 23, **24**, 28, 36, 61
anatina ..... 10, 12, **36**, 39, c
fasciata ..... 10, 12, **36**, 37, 41, c
gracilis ..... 10, 12, **36**, **38**, c
infundibuliformis ..... 10, 13, **36**, **43**, 44, c
lanceolata ..... 10, 32, **36**, c
setigera ..... 10, 12, **36**, **41**, 42, c
sinuosa ..... 10, 32, **36**, **40**, c
tenuirostris ..... 10, 13, **36**, 42, 43, c
Dromaiidæ c
Dromaius novæ-hollandiæ ..... 54, c
Echinococcus 24
Echinocotyle 22, **25**, 28, 45, **55**, 56
Rosseteri ..... 10, 12, **55**, 56, c
Ectopistes migratorius c
Eniconetta Stelleri c
Epision 60
plicatus 60
Erismatura
leucocephala ..... 59, c
rubida c
Fimbriaria **25**, **60**
malleus 60
mitra 60

Page.

Fringilla domestica (see Passer domesticus) 44
Fringillidæ ... c
Fuligula
cristata (see Aythya fuligula).
ferina (see Aythya ferina).
marila (see Aythya marila) ... 34
nyroca (see Aythya nyroca).
rufina (see Aythya rufina).
Gallinæ ... c
Gallus
domesticus ... 15, 27, 35, 44, 47, c
gallinaceus (see Gallus domesticus).
Gammarus ... 12
pulex ... 10, 13, 40, 41, 43
Garrulus glandarius ... 32
Genetta genetta ... 28
Geotrygon martinica ... c
Glaucion clangula (see Glaucionetta clangula).
Glaucionetta clangula ... 33, c
Globus stercoreus ... 43
Goura sp ... 44, c
Gouridæ ... c
Hæmatopus ostrealegus ... 56
Halysis
columbæ ... 53, 54
crenata ... 37
gracilis ... 38
infundibuliformis ... 43
lanceolata ... 36
setigera ... 41
sinuosa ... 40
torquata ... 40
trilineata ... 34
Harelda
glacialis (see Clangula hyemalis).
histrionica (see Histrionicus histrionicus).
Helix ... 12, 13
carthusianella ... 10, 50, 51
maculosa ... 10, 50, 51
Histrionicus histrionicus ... c
Hymenolepis ... 24, 31, 32
angulata ... 32
diminuta ... 32
farciminalis ... 32
murina ... 32
nana ... 32
nasuta ... 32
serpentulus ... 32
Hymenolepis (*Dilepis*) *lanceolata* ... 36
Hymenolepis (*Lepidotrias*) *sinuosa* ... 40
Idiogenes ... 25, 60
otidis ... 60
Krabbea ... 24
grandis ... 25
Lagopus
lagopus ... c
scoticus ... c
Laridæ ... c
Larus
canus ... 56
tridactylus (see Rissa tridactyla).
Lepidotrias ... 32
Leptotila fulviventris brachyptera ... c

Lepus Page.
arizonæ ... 55
melanotis ... 55
sylvaticus ... 55
Ligulinæ ... 23, 27
Ligula ... 23, 25, 27
alternans ... 27
digramma ... 27
monogramma ... 27
sp ... 10
uniserialis ... 27
Limax ... 12, 13
agrestris ... 10, 47
cinereus ... 47
variegatus ... 10, 47
Limosa rufa ... 56
Longipennes ... c
Lophodytes cucullatus ... c
Malacolepidota ... 28
Manis pentadactyla ... 55
Mareca penelope (see Anas penelope) ... 34
Megaloperdix Nigelli (see Tetraogallus himalayanus).
Meleagris
gallopavo ... 57, c
gallopavo mexicana ... 45, c
Melopelia leucoptera ... c
Merganser
merganser ... 38, 43, c
serrator ... 38, 43, c
Mergus
albellus ... 43, c
merganser (see Merganser merganser).
serrator (see Merganser serrator).
Mesocestoides ... 23, 24, 28, 56
ambiguus ... 28
imbutiformis ... 58
lineatus ... 28
Mesocestoidinæ ... 24, 28
Microtœnia ... 28
Monocercomonas Davaineæ tetragonæ ... 50
Musca domestica ... 10, 44
Netta rufina ... c
Nomonyx dominicus ... c
Nucifraga caryocatactes ... c
Numida ptilorhyncha ... c
Nyroca
australis (see Aythya australis).
leucophthalma (see Aythya nyroca).
Odontoglossæ ... c
Oesophagostoma columbianum ... 16
Oidemia
Deglandi ... c
fusca ... 43, c
nigra ... c
Olor
cygnus ... 34, 42, c
domesticus ... 34, 42, c
Ophryocotyle ... 23, 25, 45, 56
insignis ... 56
Lacazii ... 56
proteus ... 56
Oreortyx pictus ... c
Oriolus galbula ... 32, 54
Ortalis veluta maccali ... c
Ortyx virginianus (see Colinus virginianus).
Ostracoda ... 12

Page.

Otis tarda 44
Parus
major 32
caudatus 32
cœruleus 32
cristatus 32
palustris 32
Passeres c
Passer domesticus c
Pavo cristatus c
Pediocætes phasianellus c
Perca fluviatilis 39
Perdix
cinerea (see Perdix perdix).
coturnix (see Coturnix coturnix).
græca (see Caccabis saxatilis).
perdix c
petrosa (see Caccabis petrosa).
saxatilis (see Caccabis saxatilis).
Phasianidæ c
Phasianus
colchicus ..... 44, 52, 57, c
gallus (see Gallus domesticus).
Philacte canagica c
Phœnicopterus
antiquorum ..... 29, 31, 37, c
erythræus 31
ignipaliatus 31
minor 31
roseus 31
ruber ..... 31, c
Pica caudata 32
Picus
aurulentus 32
viridis 54
Psittaci c
Psittacidæ c
Psittacus erithacus ..... 53, 54, c
Pterocles alchata c
Ptychobothrium 24, 26
claviceps 25
Ptychophysa 28
Pulex
irritans 29
serraticeps 29
Recurvirostra avocetta 29
Rhea
americana (see Rhea rhea).
rhea c
Rheidæ c
Rhynchaspis clypeata (see Spatula clypeata).
Rissa tridactyla ..... 43, c
Scardafella inca c
Schistocephalus 27
dimorphus c
Sclerolepidota 8
Somateria
Dresseri c
molissima borealis ..... 43, c
spectabilis c
Spatula
clypeata c
rhynchotis c
Staphylocystis 32
Starnœnas cyanocephala c

Page.

Stictœnas arquatrix (see Columba arquatrix).
Struthio
australis c
camelus c
Struthiones c
Struthionidæ c
Sturnus vulgaris 32
Tadorna vulpanser (see Tadorna tadorna) .. 38
tadorna c
Tænia 23, 26, 28, 56, 61
acutissima 36
æquabilis 33
agama ..... 44, 52, 53, c
anatina 39, 40
anatis β lineata 34
marila 59
tadornæ 32
angulata 32
anseris 36
anserum 36
argentina 46
articulis convideis 43
australis 51, 54
avium 43
Bairdi c
bifaria 29, 30
bonasiæ c
bothrioplites 16, 49
bothrioplitis 49, 50, 51, 52
breviarticulata 40, 41
cantaniana ..... 10, 46, 57, c
Caroli c
cesticillus 48, 49
phasianorum 49, 52, 53
circumcincta 54
circumvallata 47
clavulus 46
collari nigro 40
collaris 40
collo longissimo 38
conica ..... 10, 34, 35, c
conoidea 43
coronula 33, 55
crassula 53
crateriformis 32, 54
crenata 38
Creplini c
cuneata 35, 43
cylindrica c
Delafondi ..... 10, 57, c
digonopora 29, 30
diminuta 32
echinobothrida 49, 50, 51, 52
exilis ..... 10, 58, c
fallax c
fasciata 37, 38
filiformis c
flavescens 32
flavopunctata 32
fragilis c
Friedbergeri 49, 52
frontina 54
furcigera 34
gracilis 38, 39
tadornæ 38

Page.

Tænia grœnlandica c
imbutiformis ..... 10, 28, 58, c
infundibuliformis 43, 44, 45, 48, 49, 61
anserum 40
phasianorum 49, 52, 53
infundibulum 43
insignis 54
Krabbei 42
lævis ..... 29, 40, c
lamelligera 29, 31
lanceolata 36, 37, 42, 55, 56
larina 54
leptosoma 54
liguloides c
linea c
lineata ..... 34, 35, c
Linstowi c
liaphallos c
longirostris 34
malleus ..... 10, 60, c
macracanthos c
marginata 28
megalops 10, 35, 58
micracantha c
micrancristota c
microps 54
microscopica c
microstoma 32
moschata c
multistriata c
nana 32
nasuta 32
nigropunctata ..... 45, 59, c
obvelata c
octacantha c
odiosa c
pachycephala c
parviceps c
pediformis c
pigmentata 47, 48
polymorpha 29
porosa ..... 32, 40, c
proglottidina 47
proglottina 47
purpurata 32
rhomboidea 34, 35, 40
saginata 28
scalaris 32
scutigera 32
serpentiformis i T. turturis 53
serpentulus 32
serrata 43
setigera 37, 41, 42
sinuosa 32, 37, 40, 41, 42
solium 23

Page.

Tænia sp. conard MS. ..... 10, 59, c
sp ..... 10, 59, c
sphenocephala 53, 54, 57
sphenoides 35
struthio cameli 54
struthionis 54
tauricollis ..... 46, c
tenuirostris 43
tenerrina c
teres c
tetragona 49, 50, 51, 52
tiara 32
torquata 40
transverse-elliptica c
trichosoma c
trilineata ..... 10, 34, 35, c
tuberculata 31
tuberculata 30, 31
tumens 54
turturis 54
undulata 32
villosa c
Tæniidæ ..... 23, 28, c
Tæniinæ 24, 28
Tetrabothriidæ c
Tetrabothrium
cylindraceum c
macrocephalum c
Tetrao
bonasia (see Tetrastes bonasia).
tetrix ..... 54, c
urogallus ..... 54, c
Tetraogallus himalayanus ..... 54, c
Tetraonidæ c
Tetrastes bonasia c
Tinca vulgaris 27
Trichodectes canis 29
Tringa alpina 56
Turdus
atrigularis 32
iliacus 32
merula 32
musicus 32
pilaris 32
saxatilis 32
torquatus 32
viscivorus 32
Turtur
auritus (see Turtur turtur).
turtur ..... 53, c
Tympanuchus americanus c
Viverra genetta 28
Zenaida zenaida c
Zenaidura macroura c

BIBLIOGRAPHY OF THE TAPEWORMS OF POULTRY.

By ALBERT HASSALL.

[Papers the dates of which are inclosed in parentheses are not accessible to me. All other references have been verified.]

AIRLOING.

1875.—Note sur la place d'un ténia de la poule (*Phasianus gallus*), incomplètement étudié par Dujardin. <Recueil de Méd. Vét., 6e sér., T. II, pp. 427–431.

BAIRD, W.

1853.—Catalogue of the species of Entozoa, or Intestinal Worms, contained in the Collection of the British Museum. London. 132 pgs. Tab. I–II.

BAŢSCH, A. J. G. C.

(1786.)—Naturgeschichte der Bandwurmgattung überhaupt und ihrer Arten insbesondere, nach den neuern Beobachtungen in einem systematischen Auszuge. Halle. 298 pgs., Tabs. I–V.

BELLINGHAM, O'BRYEN.

1844.—Catalogue of Irish Entozoa, with observations. <The Ann. and Mag. of Nat. Hist., Vol. XIII, pp. 101–105, 167–174, 254–260, 335–340, 422–430; Vol. XIV, pp. 162–165, 251–256, 317–323, 396–403, 471–479. London.

BERTKAU.

1875.—See Cornelius, 1875.

BLANCHARD, RAPHAËL.

1891A.—Note sur les migrations du *Tænia gracilis* Kr. <Bull. Soc. zool. France, XVI, pp. 119–122, 1 fig. Reprinted. <C. R. Soc. Biol., Paris, 9e sér., III, séance du 9 mai (pub. 15 mai), pp. 330–332.

1891B.—Notices helminthologiques (2 sér.): 6.—Sur les Téniadés a ventouses armées. <Mém. Soc. zool. France, IV, pp. 420–443, figs. 1–20.

1891C.—Histoire zoologique et médicale des Téniadés du genre *Hymenolepis* Weinland. Paris. 112 pgs., 22 figs.

1894.—Notices sur les parasites de l'homme (3e série): IV.—Sur le *Krabbea grandis*, et remarques sur la classification des Bothriocéphalinés. <C. R. Soc. Biol., 10e sér., I, No. 27, séance du 3 nov. (pub. 9 nov.), pp. 699–702.

BLOCH, M. E.

(1779.)—Beitrag zur Naturgeschichte der Würmer, welche in anderen Thieren leben. <Beschäft. d. Berl. Ges. nat. Frde., IV, pp. 534–561, Taf. XII, figs. 3–5, Taf. XIV–XV.

1782.—Abhandlung von der Erzeugung der Eingeweidewürmer und den Mitteln wider dieselben. Berlin. 4°. 54 pgs., 10 pls.

CLOUET, J.

(1872.)—Note sur le Tænia crassule du pigeon, sur la gapes, maladie des jeunes poulets. <Soc. des Amis Sci. nat., Rouen, 6e et 7e ann. (1870–1871), pp. 49–53.

COBBOLD.

1859.—On some new forms of Entozoa. <Trans. Linnean Soc. London, XXII (1856–1859), pp. 363–366, Tab. LXIII.

1861.—List of Entozoa, including Pentastomes, from animals dying at the society's menagerie, between the years 1857–60 inclusive, with descriptions of several new species. <Proc. Zool. Soc. London, pp. 117–127, Pl. XX.

CORNELIUS.

1875.—Taubenbandwurm. <(Sitz. d. niederrheinischen Gesellschaft für Natur- und Heilkunde in Bonn) Verh. d. natur-hist. Vereins d. pr. Rheinland u. Westfalens, XXXII, iv, 2, pp. 182–183.

CREPLIN.

1825.—Observationes de Entozois. P. I. Gryphisw. 8°. 86 pgs., 1 Taf.,

(1839.)—Eingeweidewürmer. <Ersch und Grube's Encycl., XXXII, pp. 277–302. Leipzig.

1846.—Nachträge zu Gurlt's Verzeichniss der Thiere, bei welchen Entozoen gefunden worden sind. <Arch. f. Naturg., 12. Jhg., 1. Bd., Berlin, pp. 129–160.

CRETY, C.

1890.—Cestodi della *Coturnix communis* Bonn. <Boll. Mus. Zool. ed Anat. Comp. Univ. Torino, Vol. V, N. 88, pp. 1–16, 1 tav. (Actual date of publication, Oct. 7, 1890.)

DAVAINE, C.

1877.—Traité des Entozoaires et des maladies vermineuses de l'homme et des animaux domestiques. Paris. 2e éd., CXXXII pgs., 72 figs.; 1003 pgs., 38 figs.

DIAMARE, V.

1893A.—Note su' Cestodi. <Boll. Soc. Nat. Napoli, Ser. 1, Vol. 7, Fasc. I—II, pp. 9–13. (Actual date of publication, Aug. 28, 1893.)

1893B.—Le funzioni dell' ovario nella *Davainea tetragona* Mol. <Rend. R. Accad. sci. fis. e matem. Napoli, fasc. 8–12. Adun., 9 Dec., 4°, 7 pgs. (reprint), 4 figs.

DIESING, C. M.

1850.—Systema helminthum. I. Vindobonæ. 680 pgs.

1863.—Revision der Cephalocotyleen: Abth. Paramecocotyleen. <Sitzbr. k. Akad. Wiss. Wien, Math., nat. Cl., Bd. 48, 1. Abth., pp. 200–345.

1864.—Revision der Cephalocotyleen: Abth. Cyclocolyteen. <Sitzbr. k. Akad. Wien, XLIX, 1. Abth., pp. 357–430.

DONNADIEU, A. L.

1877.—Contribution à l'histoire de la Ligule. <Journ. de l'Anat. et de la Phys., XIII, pp. 324–370, 451–497, Pl. XIV–XX. (Contains historical review and bibliography.)

DUCHAMP, G.

(1876.)—Recherches anatomiques et physiologiques sur les Ligules. <Propos, donn. p. la Faculté Lyon, Paris, 64 pgs., 2 Pls. Abstr. <Journ. d. Zool., T. V, pp. 372–373.

1877.—Sur les conditions de développement des Ligules. <C. R. Ac. Sci. Paris, T. 85, pp. 1239–1240.

1878A.—Sur les conditions de développement des Ligules. Deuxième note. <C. R. Ac. Sc. Paris, T. 86, pp. 493–494. Rev. <Rev. scientif. (1877–1878), No. 35, p. 833.

1878B.—Expériences sur les conditions du développement des Ligules. <Ann. Sci. Nat., 6e sér., Zool., T. VII, No. 2–4, Art. No. 7, 1 pg. —— Abstr. as: The Development of Ligula. <Ann. and Mag. Nat. Hist., Vol. II, 5th ser., p. 498. (Abstract of Duchamp, 1877 and 1878.)

DUJARDIN, FÉLIX.

1845.—Histoire naturelle des Helminthes, ou vers intestinaux. Paris. 654 pgs., Pls. I–XII.

FEUEREISEN, J.

1868.—Beitrag zur Kenntniss der Taenien. <Zeitschr. f. wiss. Zool., Bd. XVIII, Heft 2, pp. 161–205, Taf. X.

FILIPPI, C. DE.

1892.—Nota preliminare sul sistema riproduttore della *Tænia bothrioplitis* Piana. <Boll. Soc. Rom., Stud. Zool., Ann. 1, pp. 75–79, tav. 1.

FRIEDBERGER.

1877.—Bandwurmseuche unter den Fasanen. <Zeitschr. f. Vet.-Wissenschf., V, No. 3, März, pp. 97–112, figs.

FRIIS.

(1870.)—En hidtil ubeskreven Baendelorm hos Fugle (Ophryocotyle proteus). <Vidénskab. Meddel. fra den Naturhist. For Kjöbenhavn (1869), pp. 121–124, 1 tav.

FRISCH, J. L.

(1727.)—De tæniis in anserum intestinis. <Miscell. Berolinensia, ad incrementum scientiarum ex scriptis Societati Regiæ Scientiarum exhibitis. Contin. II, Berolini, p. 42.

1781.—Von Bandwürmern in den Gedärmen der Gänse. <Physicalische u. medicinische Abhandlungen der k. Acad. d. Wiss. zu Berlin, I, pp. 155–156.

FRÖLICH, J. A.

1789.—Beschreibung einiger neuen Eingeweidewürmer. <Der Naturforscher, XXIV, pp. 101–162, Tab. IV.

1791.—Beiträge zur Naturgeschichte der Eingeweidewürmer. <Der Naturforscher, XXV, pp. 52–113, Tab. III.

1802.—Beiträge zur Naturgeschichte der Eingeweidewürmer. <Der Naturforscher, XXIX, pp. 5–96, Tab. I–II.

GERVAIS.

1847.—Sur quelques Entozoaires tænioïdes et hydatides. <Acad. Sci. et Lettres de Montpellier, Mém. de la Sec. d. Sci., T. I, pp. 85–103, Pl. I–II.

GIEBEL, C.

1857.—Chr. L. Nitzsch's helminthologische Untersuchungen. <Zeitschr. ges. Naturwiss., Bd. IX, pp. 264–269. Berlin.

GMELIN.

1790.—Systema naturæ. Tom. I, Pars. VI, (pp. 3021–3909). (Leipsic ed.)

GOEZE, J. A. E.

1782.—Versuch einer Naturgeschichte der Eingeweidewürmer thierischer Körper. Blankenburg, 471 pgs., 35 plates.

GRASSI, B., & ROVELLI, G.

1888.—Bandwürmerentwickelung. I. <Centralbl f. Bakt. und Parasitenk., III, p. 173.

1889A.—Embryologische Forschungen an Cestoden. <Centralbl. f. Bakt. und Parasitenk., V, pp. 370–377, figs. 1–4, pp. 401–410.

1889B.—Intorno allo sviluppo dei Cestodi. <Bull. Mensile Accad. Gioenia Sci. Nat. Catania, Fasc. VIII, pp. 4–5.

1892.—Ricerche embriologiche sui Cestodi. <Atti Accad. Gioenia Sci. Nat. Catania, Anno LXVIII (1891–1892), Ser. IV, Vol. IV, Memoria II, pp. 1–108, Tav. I–IV.

HAMANN, OTTO.

1889.—In *Gammarus pulex* lebende Cysticerkoiden mit Schwanzanhängen. <Jen. Zeitschr. f. Naturw. (1889–1890), Bd. XXIV, n. F., XVII, pp. 1–9, Taf. I. (Actual date of publication, Nov. 20, 1889.)

1891.—Neue Cysticercoiden mit Schwanzanhängen. <Jen. Zeitschr. f. Naturw. (1890–1891), Bd. XXV, n. F. XVIII, pp. 553–564, Taf. XXIV. (Actual date of publication, May 30, 1891.)

HASSALL, ALBERT.

1896A.—Check list of the Animal Parasites of Chickens. <Circular No. 9, pp. 1–7, Bureau of Animal Industry, U. S. Department of Agriculture.

1896B.—Check list of the Animal Parasites of Turkeys. <Circular No. 12, pp. 1–3. Bureau of Animal Industry, U. S. Department of Agriculture.

1896C.—Bibliography of the tapeworms of Poultry. <Bulletin No. 12, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C. pp. 81–88. The present paper.

ITZIGSOHN.

? ? Quoted by Railliet, 1893, p. 329.

JANSON.

1893.—Die Hausthiere in Japan. IV. Die Krankheiten der Hausthiere in Japan. <Arch. f. wiss. u. prakt. Thierheilkunde, XIX, pp. 241–276.

KOWALEWSKY, M.

1894A.—Materyaly do fauny helmintologicznej pasorzytniczej polskiej, 1. <? pp. 1–8.

1894B.—Fauna helmintologiczna pasorzytnicza Krajowa naszych zwierząt i róslin uzytecznych oraz czlowieka. <Rocznika Krajowei, etc., pp. 214–227.

1894C.—Studya helmintologiczne, 1. (Helminthologische Studien, 1.) <Anz. der Akademie der Wissenschaften in Krakau, November, pp. 278–280, 1 Taf.

1895.—Studya Helmintologiczne, 1. <Rozpraw Wydzialu matematyczno-przyrodniczego Akademii Umiejetnosci w Krakowie, Tom XXIX, pp. 349–367, T. VIII.

KRABBE, H.

1867.—Trappens Bændelorm. <Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn, for Aaret 1867, Nr. 4–7, pp. 122–126, Tab. III.

1869.—Bidrag til Kundskab om Fuglenes Bændelorme. <Kgl. Dansk Vidensk. Selsk. Skrifter, 5. R., Naturvid. og math. Afd. 8. Bd. VI, 1870, pp. 251–363; Résumé: Recherches sur les Ténias des oiseaux, pp. 364–368, Taf. I–IX. (Author's extras published 1869.)

1882.—Nye Bidrag til Kundskab om Fuglenes Bændelorme. <Vidensk. Selsk. Skrifter, 6. Række, Naturvid. og math. Afd. I. 7, pp. 345–366, Tab. I–II.

KREFFT, G.

(1871.)—On Australian Entozoa, including a list of the species hitherto recorded, and descriptions of 16 new tapeworm colonies, with figures of each drawn from fresh specimens. <Trans. Ent. Soc. New South Wales, pp. 206–232, 3 plates. Also separate, 28 pages, 3 plates. 8°.

LINSTOW, O. VON

1872A.—Ueber den *Cysticercus tæniæ gracilis*, eine freie Cestoden-amme des Barsches. <Arch. f. mikr. Anat., VIII, pp. 535–537, Pl. XXI, figs. 1–5.

1872B.—Sechs neue Taenien. <Arch. f. Naturges., 38. Jhg., I, pp. 55–58, Taf. III.

1878.—Compendium der Helminthologie. Hannover. (Actual date of publication, May 16, 1878.)

1889.—Compendium der Helminthologie. Nachtrag. Hannover.

1892A.—Beobachtungen an Helminthenlarven. <Arch. f. mikr. Anat., XXXIX, pp. 325–343, Taf. XV.

1892B.—Beobachtungen an Vogeltaenien. <Centralbl. f. Bakter. u. Parasitenk., XII, 7 Oct., pp. 501–504, figs. 1–3.

1893.—Helminthologische Studien. <Jenaische Zeitschrift für Naturwissenschaft, XXVIII Bd., n. F., XXI, pp. 328–342, Taf. XXII–XXIII.

LÖNNBERG, EINAR.

1889.—Bidrag till Kännedomen om i Sverige förekommande Cestoder. <Bihang till k. Svenska Vet-Akad. Handlingar, Bd. 14, Afd. IV, No. 9, pp. 1–69, Taf. I–II.

1890.—Helminthologische Beobachtungen von der Westküste Norwegens. <Bihang till k. Svenska Vet.-Akad. Handlingar, Bd. 16, Afd. IV, No. 5, pp. 1–47.

LÜPKE, F.

1892.—Parasitologisches. *Tænia crassula* in einem Papagei. <Repert. d. Thierheilkunde, Jhg. 53, pp. 257–264.

MAGALHÃES.

1892.—Notes d'helminthologie brésilienne. I.—*Tænia cuneata* von Linstow, 1872. <Bull. Soc. zool. France, XVII, pp. 145–146.

MÉGNIN, P.

1878A.—Épizooties vermineuses chez les jeunes faisans. <(Bull. Soc. cent. méd. vét.) Recueil de méd. vét., 6e sér., V, pp. 825–829. Discussion, pp. 830–831. Pub. 30 août.

1878B.—Supplement (to 1878A). <Rec. méd. vét., 6e sér., V, pp. 927–928, Pl. IV. Pub. 30 Sept.

1880A.—De la caducité des crochets et du scolex lui-même chez les Ténias. <Bull. Soc. zool. France, V (3–4), pp. 117–120.

1880B.—De la caducité des crochets et du scolex lui-même chez les Ténias. <Recueil de méd. vét., VII, 6e sér., pp. 393–396. Discussion, pp. 393–394.

1880C.—Sur la caducité des crochets et du scolex lui-même chez les Ténias. <C. R. Acad. Sci. Paris, XC, pp. 715–717. (Nearly the same as 1880B, pp. 393–396, but abbreviated).

1881A.—De la caducité des crochets et du scolex lui-même chez les Ténias. <Journ. Anat. et Phys., Paris, XVII, pp. 27–44, Pl. IV–V.

1881B.—Sur la caducité des crochets et du scolex lui-même chez les Ténias. <C. R. Soc. Biol., 7e sér., T. II, pp. 124–127 (séance du 13 mars 1880). (Almost verbatim, same as 1880B, pp. 393–396.)

1891.—Un nouveau Ténia du pigeon ou plutôt une espèce douteuse de Rudolphi réhabilitée. <C. R. Soc. Biol. Paris, 9e sér., T. III, pp. 751–753, figs. a–f.

MOLIN, R.

1858.—Prospectus helminthum, quæ in prodromo faunæ helminthologicæ Venetiæ continentur. <Sitzber. k. Akad. Wiss. Wien, math.-naturw. Cl., Bd. XXX, pp. 127–158.

1861.—Prodromus faunæ helminthologicæ Venetæ adjectis disquisitionibus anatomicis et criticis. <Denkschr. k. Akad. Wiss. Wien, Bd. XIX, pp. 189–338, 15 Taf.

MONIEZ, R.

1891.—Notes sur les Helminthes. II. Sur les Cysticerques des Ostracodes d'eau douce. <Rev. Biol. Nord France, IV, pp. 25–26.

MONTICELLI, F. SAV.

1889.—Notes on some Entozoa in the collection of the British Museum. <Proc. Zool. Soc. London, pp. 321–325, Pl. XXXIII.

1891.—Notizie su di alcune specie di Tænia. <Boll. Soc. Nat. Napoli, Ser. I, Vol. V, Fasc. II, pp. 151–174, Tav. VIII.

MOORE, V. A.

1895.—A nodular Tæniasis in fowls. <Circular No. 3, Bureau of Animal Industry, U. S. Dept. Agric., 4 pgs., figs, 1–2.—Abstr., as: A nodular disease of fowls associated with tapeworm. <N. Y. Med. Journ., Vol. LXII, No. 12, pp. 373–374.—Abstr. < pp. 15–17 Bull. 12. Bureau of Animal Industry. 1896.

MRÁZEK, AL.

1890.—Ueber Cysticercoiden unserer Crustaceen. <Sitzber. k. böhm. Ges. Wiss., math.-nat. Cl., Jhg. 1890, Bd. I, pp. 226–248, Taf. V, figs. 1–14; VI, figs. 15–17. (Text Bohemian.)

1891.—Beiträge zur Entwickelungsgeschichte einiger Vogelbandwürmer. <Sitzber. k. böhm. Ges. Wis., math.-nat. Cl., Jhg. 1891, pp. 97–131, Taf. V, figs. 1–17; VI, figs. 18–27. (Text Bohemian.) Résumé and explanation of plates in French: Recherches sur le développement de quelques Ténias, pp. 126–131.

MÜLLER, O. F.

(1782.)—Vom Bandwurme des Stichlings und vom milchigten Plattwurme. <Der Naturforscher, XVIII, pp. 21–37, I Taf.

NEUMANN, L. G.

1888.—Traité des maladies parasitaires non microbiennes des animaux domestiques. 673 pgs., 306 figs. Paris.

1892A.—Traité des maladies parasitaires non microbiennes des animaux domestiques. 2e éd. 767 pgs., 364 figs. Paris.

1892B.—A Treatise of the Parasites and Parasitic Diseases of the Domesticated Animals. 800 pgs., 364 figs. London. Translation of 1892 A, by Fleming.

OWEN, R.

1835.—Description of a new tapeworm, *Tænia lamelligera*, Owen. <Trans. Zool. Soc. London, I, pp. 385–386, Pl. XLI, figs. 21–23.

PAGENSTECHER.

(1858.)—Beitrag zur Kenntniss der Geschlechtsorgane der Taenien. <Zeitschr. f. wiss. Zool., IX, pp. 523–528, Taf. XXI.

PALLAS, P. S.

(1781.)—Bemerkungen über die Bandwürmer in Menschen und Thieren. <Neue nord. Beyträge z. physik. und geogr. Erd- und Völkerbeschreibung, Naturg. u. Oeconomie, Bd. I, Petersb. u. Leipzig, pp. 39–112, 2 Taf.

PARONA, C.

(1885.)—Di alcuni elminti raccolti nel Sudan orientale da O. Beccari e P. Magretti. <Ann. Mus. Civ. Genova, Ser. II, Vol. II, pp. 424–445, Tav. VI–VII.

(1887A.)—Elmintologia sarda. Contribuzione allo studio dei vermi parassiti in animali di Sardegna. <Ann. Mus. Civ. Genova, Ser. II, Vol. IV, pp. 275–384, Tav. V–VII.

(1887B.)—Res ligusticae II. Vermi parassiti in animali della Liguria. Nota preventiva. <Ann. Mus. Civ. Genova, Ser. II, Vol. IV, pp. 483–501.

1894.—L' Elmintologia italiana. Da' suoi primi tempi all' anno 1890. Storia, sistematica, corologia e bibliografia. <Atti R. Università Genova, XIII, 4°, 733 pgs., 1 map.

PASQUALE, ALESSANDRO.

1890.—Le Tenie dei polli di Massaua (descrizione di una nuova specie). <Giorn. Internaz. Sci. Med., Anno XII, Fasc. 23, 15 dicembre, pp. 905–910, 1 Tav., 11 figs.

PERRONCITO, E.

1882.—I parassiti dell' uomo e degli animali utili. 506 pgs., 233 figs. Milano.

1886.—Trattato teorico-pratico sulle malattie più comuni degli animali domestici. 434 pgs., 220 figs. Torino.

PIANA, G. P.

1881.—Una nuova specie di Tenia della gallina (*Tænia bothrioplites*) e di un nuovo Cisticerco delle lumachelle terrestri (*Cisticercus bothrioplites*). <Rendiconto Accad. Sci. Inst. Bologna (Anno accad., 1880–1881), pp. 84–85.

1882.—Di una nuova specie di Tenia del gallo domestico (*Tænia bothrioplitis*) e di un nuovo Cisticerco delle lumachelle terrestri (*Cysticercus bothrioplitis*). <Mem. Accad. Sci. Inst. Bologna, Ser. 4, Tom. II (1880–1881), pp. 387–394, 1 double plate w. 8 figs.

POLONIO, A. F.

1860A.—Novæ helminthum species. <Lotos (Prag), Feb., X, pp. 21–23.

1860B.—Catalogo dei cefalocotilei italiani, e alcune osservazioni sul loro sviluppo. <Atti Soc. Ital. Sci. Nat., II, pp. 217–229, Tav. VII, Milano (1859–1860).

RAILLIET, A.

1886.—Éléments de zoologie médicale et agricole. Paris. 1053 pgs., 705 figs.

1892A.—Sur un Ténia du pigeon domestique, représentant une espèce nouvelle (*Tænia Delafondi*). <C. R. Soc. Biol. Paris, 9e sér., T. IV (séance du 23 jan., pub. 29 jan.), pp. 49–53.

RAILLIET, A.—Continued.

1892B.—Notices parasitologiques. VII.—*Tænia tenuirostris* Rud. chez l'oie domestique; remarques sur la classification des Cestodes parasites des oiseaux. <Bull. Soc. Zool. France, XVII, No. 5, pp. 115–116.

1893.—Traité de zoologie médicale et agricole. I. Fasc., pp. 1–736, figs. 1–494.

1896.—Quelques rectificatious à la nomenclature des parasites. <Rec. d. Méd. Vét., VIII^e. sér., Tom., III, No. 5, pp. 157–161.

—— & LUCET.

1892.—Sur le *Davainea proglottina* Davaine. <Bull. Soc. zool. France, XVII, No. 5, pp. 105–106.

RICHARD, J.

1892.—Sur la présence d'un Cysticercoïde chez un Calanide d'eau douce. <Bull. Soc. zool. France, XVII, No. 1, pp. 17–18.

RIEHM, G.

1882.—[Fütterungsversuche mit *Ligula simplicissima.*] <Zeitschr. naturw. Ver. Halle, LV, pp. 328–330.

RIVOLTA, S., e DEL PRATO, P.

(1881.)—L'ornitoiatria, o la medicina degli uccelli domestici e semi-domestici. Pisa.

ROSA, VINCENZO.

(1794.)—Lettere zoologiche, ossia osservazioni sopra diversi animali. <Giorn. Fis. Medico del Brugnatelli, Vol. IV, Ann. VII, pp. 258–269.

ROSSETER, T. B.

1890.—Cysticercooids parasitic in *Cypris cinerea.* <Journ. Micr. and Nat. Sci., III, n. s., Vol. IX, pp. 241–247, Pl. XVI–XVII.

1891A.—[Life history of *Tænia lanceolata.*] <Journ. R. Micr. Soc., June, 2 ser. 11, p. 438.

1891B.—Sur un Cysticercoïde des Ostracodes, capable de se développer dans l'intestin du canard. <Bull. Soc. zool. France, XVI, pp. 224–228.

1892.—On a new Cysticercus and a new Tapeworm. <Journal Queckett Micr. Club, Ser. II, Vol. IV, No. 30, Jan. (read Oct. 16, 1891), pp. 361–366, Pl. XXII–XXIII.

1893.—On the Cysticercus of *Tænia microsoma* and a new Cysticercus from *Cyclops agilis* (Rosseter). <Journ. Queckett Micr. Club (2), V, No. 32, July (read Nov. 18, 1892), pp. 179–182, Pl. X.

1894.—On *Cysticercus quadricurvatus* Ross. <Journ. Queckett Micr. Club (2), V, No. 34 (read Nov. 19, 1893, pub. April, 1894), pp. 338–343, Pl. XVII.

RUDOLPHI, C. A.

1793.—Observationes circa vermes intestinales. Diss. In. Fasc. I. Gryphiswald, 46 pgs.

(1795.)—Observationes, Fasc. 2.

1802.—Fortsetzung der Beobachtungen über die Eingeweidewürmer. <Arch f. Zool. u. Zoot. II, St. 2, pp. 1–67, Taf. I.

1810.—Entozoorum sive vermium intestinalium historia naturalis, Vol. II, pgs. II, 386 pgs.

1814.—Erster Nachtrag zu meiner Naturg. d. Eingeweidewürmer. <Ges. Naturf. Freunde Berlin, Mag. f. d. neust. Entd. i. d. ges. Naturkde., VI. Jhg., Berl., pp. 83–113.

1819.—Entozoorum synopsis. Berlin. 811 pgs Tab. I–III.

SCHMIDT, JOHS. EM.

1894.—Die Entwicklungsgeschichte und der anatomische Bau der *Tænia anatina* (Krabbe). <Arch. f. Naturg., Jhg. 60, Bd. I, pp. 65–112, Taf. VI. —— Also as Inaug.-Diss. Leipzig, pp. 1–50, I Taf. —— Ref. by Max Braun. <Centralbl. Bakter. und Parasitenk., XVI, pp. 756–758. ——Review as: Development of *Tænia anatina.* <Journ. R. Micr. Soc. London, P. I, p. 58.

SCHRANK, F. v. P.
(1788.)—Verzeichniss der bisher hinlänglich bekannten Eingeweidewürmer, nebst einer Abhandlung über ihre Anverwandtschaften. München.
1803.—Fauna Boica. Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. Landshut, 3. Bd., 2. Abth., 372 pgs. (Eingeweidewürmer, pp. 117–248.)
SCOPOLI, J. ANT.
1772.—Annus V. historico-naturalis. Lipsiæ. 128 pgs. 8°.
SCOTT, TH.
1891.—Notes on a Small Collection of Fresh-water Ostracoda from the Edinburgh District. <Proc. R. Physical Soc., Edinb., X (1890–1891), part 2, pp. 313–317, 1 fig.
SCOULAR, JOHN.
1829.—Account of the Tænia found in the Intestines of the Common Grouse (*Tetrao scoticus*). <Edinb. New Philos. Journ., XX (1828), pp. 81–83.
SIEBOLD, C. TH. v.
1837.—Zur Entwickelungsgeschichte der Helminthen. < K. F. Burdach's: Die Physiologie als Erfahrungswissenschaft, Bd. II, 2. Aufl., Leipzig, pp. 183–213.
1848.—Lehrbuch der vergleichenden Anatomie, Bd. I. (Wirbellose Thiere.)
1854.—Comparative anatomy. From the German, with notes and additions by Waldo I. Burnett, M. D. Boston. 470 pgs. (Translation of 1848.)
STEUDENER, F.
1877.—Untersuchungen über den feineren Bau der Cestoden. < Abh. Ges. Halle, XIII, pp. 277–316, Pl. XXVIII–XXXI.
STILES, CH. WARDELL.
1896.—Report upon the Present Knowledge of the Tapeworms of Poultry. <Bulletin No. 12, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C. pp. 1–79, Pls. I–XXI. The present paper.
STOSSICH, M.
1890A.—Elminti veneti raccolti dal Dr. Alessandro Conte de Ninni. <Boll. Soc. Adriat. Sci. Nat., Vol. XII. pp. 49–56. Trieste.
1890B.—Elminti veneti raccolti dal Dr. Alessandro Conte de Ninni. < Boll. Soc. Adriat. Sci. Nat., Trieste, XII, pp. 49–56.
1891.—Elminti veneti raccolti dal Dr. Alessandro Conte de Ninni. IIª Ser. < Boll. Soc. Adriat. Sci. Nat., Trieste, XIII, pp. 109–116, Tav. I.
1892.—Osservazioni elmintologiche. < Soc. Hist. Nat. Croatica, T. VII, Agram. 10 pgs., 2 Tav.
VILLOT.
(1875.)—Faune helminthologique de la Bretagne. < Arch. Zool. Expér.. Bd. IV, p. 478, Pl. XII, f. 92.
WEINLAND, D. F.
1858.—Human Cestoides. An Essay on the Tapeworms of Man, giving a full account of their nature, organization, and embryonic development; the pathological symptoms they produce, and the remedies which have proved successful in modern practice. To which is added an appendix, containing a catalogue of all species of *helminthes* found in man. 8°. 93 pgs., 12 figs. Cambridge (Mass.). (Actual date of publication, prior to Sept. 30, 1858.)
ZEDER, J. G. H.
1800.—Erster Nachtrag zur Naturgeschichte der Eingeweidewürmer, mit Zufässen und Anmerkungen herausgegeben. Leipzig. 4° 320 pgs., VI Taf.
1803.—Anleitung zur Naturgeschichte der Eingeweidewürmer. Bamberg. 432 pgs. 8°. 4 Taf.
ZÜRN.
1882.—Die Krankheiten des Hausgeflügel. Weimar. 237 pgs., 76 figs.